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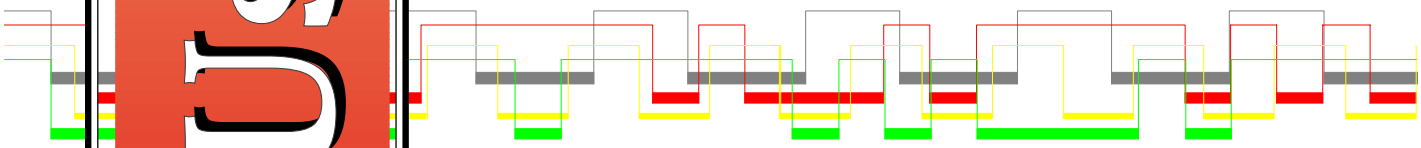
User's Manual

SM25

Production
Source-Measure Module



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Chapter 1
General Information

1.1 About This Manual

This manual provides installation and operation information for the Interface Technology SM25 VXI Source Measure Module. Information contained herein is intended for use by technical personnel involved in the actual installation and operation of the subject equipment.

Information contained in this manual is arranged as follows:

Chapter 1	General Information
Chapter 2	SM25 Soft Front Panel Operation
Chapter 3	Programming with VXI Plug & Play Drivers
Chapter 4	Programming Examples
Chapter 5	Calibration
Appendix A	SM25 VXI Interface Registers
Appendix B	Options and Accessories
Appendix C	SM25 Specifications

1.2 Equipment Description

The SM25 is a Dual-Channel Source-Measure instrument designed with high throughput in mind. Packaged in a single-wide VXI C-size module, the SM25 is a register-based instrument capable of making single-point measurements in 1 ms simultaneously on each channel. Or, using the internal comparator, the SM25 can perform simple pass/fail tests at comparable speeds. To further improve test speeds, range settings can be changed 100 times per second (10 ms) and settings within the same range at 1000 per second (1 ms). Intelligent placement of the two-channel's control registers allow both onboard instruments to be programmed using a single VXI register write.

The SM25 is a fully programmable instrument, capable of sourcing and measuring voltage or current simultaneously on both channels. The SM25 is actually four instruments per channel. Each channel can:

- o source voltage
- o measure voltage
- o source current
- o measure current

The SM25 can source and measure voltages from 20 µV to 25 V in three ranges, and can source and measure current from 50 pA to 1000 mA in seven ranges. Both the source voltage and the source current settle to specified accuracy in as little as 150 µs, typically. To extend the capabilities further, the SM25 uses floating grounds so that multiple channels may be connected in parallel for higher current or, optionally, in series for increased voltage. To facilitate integrating the SM25 with other test instruments, the SM25 can accept and source triggers on the VXI backplane, allowing host-free sequencing of complex test scenarios. Also, each channel provides an isolation relay to isolate the SM25 from the Device Under Test (DUT) while other instruments are actively driving the DUT. Selectable integration and the averaging

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of multiple measurements enhance sensitivity for critical applications.

Other features include programmable delay and fast integrating measurements, four operating modes: DC/Fixed/Sweep/Append, storage for 8,190 readings in internal memory, 255 state memory for to sequencing through stored settings, 0.1% basic accuracy, four-wire Kelvin connections with driven guard, and four quadrant source operation.

1.3 Operation Overview

The fundamental operating modes for the SM25 are as follows:

Mode 1. Source I / Measure V

Mode 2. Source V / Measure I

Mode 3. Measure V only (as a V meter)

Mode 4. Measure I only (as a I meter)

Mode 3 is the extension of mode 1 and mode 4 is the extension of mode 2. The various modes are determined by which of the parameters ... voltage or current ... are forced to zero, i.e., force I = 0 or force V = 0.

When the SM25 is forcing current, it also can measure the voltage and current. Users can decide to use Kelvin connections to compensate for voltage drops due to resistance in the cable, according to the testing requirements. For protection, users can set a voltage compliance to limit the maximum voltage that can be applied to the device being tested. When the measured voltage reaches the compliance value, the instrument will stop increasing the current level.

As described above, when the SM25 is forcing voltage, it also can measure the voltage and current. A current compliance setting can be used to limit the current level to the DUT value.

The SM25 comes standard with one channel, but can be optionally configured with one additional channel. The two channels share the VXI interface, but have their own control logic and DSP processor for performing measurements. This means that each channel can be configured and controlled independent of the other. One channel may be powering the DUT while measuring the Iddq, while the other channel is performing a leakage measurement on a pin. The two channels may also be controlled in unison to improve throughput. You have complete control over the manner in which the channels are used.

1.4 Applications

The SM25 addresses a variety of production applications, including testing passive components (resistors and capacitors), characterization and testing of diodes (PIN, laser, Zener, signal and LED), transistors (bipolar and FET) and IC's (pin leakage, Iddq). However, the SM25 was designed with high throughput measurements in mind, and as such, is particularly well suited for semiconductor and IC production testing. Where milliseconds mean added test cost, the SM25 offers unmatched performance with minimum test times and maximum throughput. This translates into maximum profitability. The SM25 saves rack space and is more economical than multiple bench-top instruments. It provides superior throughput and tighter integration with other

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VXI instruments in your ATE system, making the SM25 an obvious choice for your source/measure needs.

With the SM25's ability to source 25V at 800mA, or 20V at 1000mA, it can be used as a precision power source for devices being tested. The sense lines guarantee that the output voltage remains precisely at the level you set. Setting the current compliance protects the device from over-current conditions while also providing precise measurement of Iddq current.

Because the SM25 has floating grounds, multiple channels may be linked together in parallel for higher current requirements or, optionally, in series for higher voltage requirements. A two-channel module can supply 20V at 2000mA, 25V at 1600mA or, optionally, 40V at 1000mA or 50V at 800mA.

1.5 Enhanced System Versatility

The SM25 provides simple, accurate measurements in semiconductor applications. Multiple SM25 modules in a VXI test environment make a powerful semiconductor parameter analyzer. Nonstandard tests are also performed quickly and efficiently, due to the unique versatility of the SM25 module.

A single source-measure instrument eliminates most of the complicated system integration problems involved with setting up and programming individual sources and meters. This new, compact single C-size VXI module also saves rack's space and is more economical than separate components.

The SM25 comes with a robust, yet simple VXI Plug & Play driver library. Simplified programming provides big advantages when tests need to be up and running quickly. The functions within the driver library allow quick test program development, and can be called from any Windows NT API, including LabView, Visual C++ and Visual Basic. Supporting a variety of platforms further simplifies host software integration, resulting in a tight, cost effective, high performance solution for your production ATE needs.

1.6 Measurements as a Function of Voltage or Current

Measurements can be taken and recorded in the SM25's internal memory, along with corresponding values of the source voltage or current. Up to 8190 values of each variable, correlated in counts, can be accessed by the front panel. All measurement and source values along with the elapsed time can be obtained over the VXI bus. The internal memory is organized to present measurement results in a versatile and easy to understand manner. All source values and corresponding measurement values are stored in sequence and share a common index.

1.7 Source-Measure Concepts

This section will introduce several of the basic source and measure concepts of SM25. The concepts are:

- Compliance Limit: DUT protection feature that limits the voltage or current source of the SM25 .
- Temperature Message: Thermal information of the SM25 source circuit
- Source-Delay-Measure cycle: Time parameter for guaranteeing a stable measurement across the different source ranges .
- Operating Boundaries: The source limits of SM25.

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- o Basic Circuit Configurations: The circuit structure of the SM25 in different operational modes.
- o Guard: Limiting the effects of external influences on source and measure operations.
- o Power Requirements: Determining the power requirements of the SM25.

1.7.1 Principles of Compliance

The compliance function is the process of the SM25 limiting the measured value to the DUT. When the SM25 finds the measured value is near the compliance limit, the SM25 compliance circuit will stop the output from increasing and clamp the output to the compliance level. This function is similar to changing the SM25 from source voltage mode to source current mode so the current output will not exceed the compliance limit.

1.7.1.1 Compliance Limit

When the SM25 operates in the source voltage mode, the user can define the maximum current range so as to limit the current output. The function is design for DUT protection. When the current output of SM25 reaches the limit (positive or negative), this function will prevent the SM25 from increasing (or decreasing) the current output, allowing the DUT to be operated in a well-controlled environment. The SM25 while in source current mode will also limit the voltage output to protect the DUT from excessive voltages.

The SM25 has two different methods for controlling the compliance conditions:

1. The user defines the compliance value of the SM25. The DSP of the SM25 will transfer the compliance value to the D/A control bits to control the circuit. The D/A converter that controls the SM25 compliance setting is 12 bits. The minimum compliance value is 2% of the range. The maximum compliance value is the maximum value of the selected range. If users program the compliance value to less than 2% of the range, the SM25 will internally set the value to 2% of the range.

   The accuracy of the sm25 compliance limit is 1% of the selected range. When the selected range is changed, the accuracy will be changed to 1% of the new range.

2. The SM25, operating in the Auto measurement mode, sets the compliance according to the measurement range. When the SM25 is setup in the AUTO measurement mode, the input compliance value will switch to the optimum measurement range. In AUTO mode, the minimum compliance value is 2%.

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The valid compliance values for the different ranges are shown in Table 1-1 below.

Table 1-1 Compliance Values For The Different Measurement Ranges.

Measure Range	Compliance Range
25V	25V to 0.25V
5V	5V to 0.1V
500mV	500mV to 10mV
1A	1A to 20 mA
100mA	100mA to 2mA
10mA	10mA to 200µA
1mA	1mA to 20µA
100µA	100µA to 2µA
10µA	10µA to 0.2µA
1µA	1µA to 0.02µA

1.7.1.2 Compliance Examples

Example 1:

The setup of SM25 is as follows:

Source voltage =10V.

Compliance current = 10mA.

DUT resistor = 500Ω

According to Ohm's Law, the current of the DUT should be 10V/500Ω (0.02A). But the SM25 ICMPL I = 10mA, so the SM25 will clamp the output current to 10mA. The output voltage is likewise clamped to 500Ω x 10mA (5V), so the SM25 is operating as a current source rather than a voltage source.

Example 2:

The test conditions are the same as example 1, except:

Setup A: Current measurement range is set to 1A.

Setup B: Current measurement range is set to 1mA

The different results are as follows:

A. The minimum compliance value is 2% of the full scale. If the measurement range is 1A, then the minimum compliance value is changed from 10mA to 20mA and the SM25 will not activate the compliance limit during the test.

B. The measurement range is 1mA, so the maximum compliance value is changed to 1mA. The compliance function will restrict the output to 1mA, also limiting the output voltage to only 500mV.

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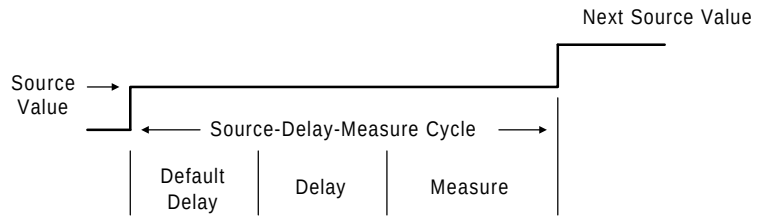
1.7.2 Temperature Message

The SM25 has a thermal monitor function, the Smart Temperature Sensor circuit, which is integral to each channels source circuit. The SMT160-30 thermal sensor is used to monitor the temperature of the driver circuit, and supplies real time temperature information to the user. When the temperature of SM25 exceeds the set point, the users can stop the instrument to prevent damage. If over temperature problems persist, the user may want to switch to a higher power mainframe or clean the filters and check for proper ventilation on their existing chassis. The SM25 is designed to operate between 0 deg and 50 deg C.

1.7.3 Source-Delay-Measure Cycle

The source measure module consists of two different functions. One is the source function (stimulus), the other is measure function (voltage or current meter). The full operation cycle is called the SDM (Source-Delay-Measure) cycle, and is shown in Figure 1-1.



Default Delay: Fixed delay for instrument settling.
Delay: Additional delay for device under test or system capacitance.
Measure: Integration time.

Figure 1-1. Source-Delay-Measure (SDM) Cycle.

Each SDM cycle has three states:

1. Set the source output level.
2. Perform the delay (default delay and user defined delay).
3. Make the measurement.

The delay is used to allow the source to settle before the measurement is made. The total time period of the delay includes a default (internal) delay and the user defined delay. The default delay is a fixed time delay based on the SM25's range setting. The users defined delay is used to compensate for the added load represented by the DUT. This allows the signal to be stable before any measurements are made, guaranteeing the most accurate measurement.. The value of the users defined delay is set by the Ton parameter.

The SM25 will have different RC delay values for each measurement range setting. When the current range is smaller, the internal delay is longer. Ideally, the default delay is approximately equivalent to 5 times the RC constants of the selected current range for either source I or source V. Normally, if the timing is not critical, the user should set the delay (user define delay) to 10 times the RC constants. The user-defined delay for the SM25 can be set from 0msec to 65sec. The stimulus response curve of the SM25 is shown as Fig 1-2.

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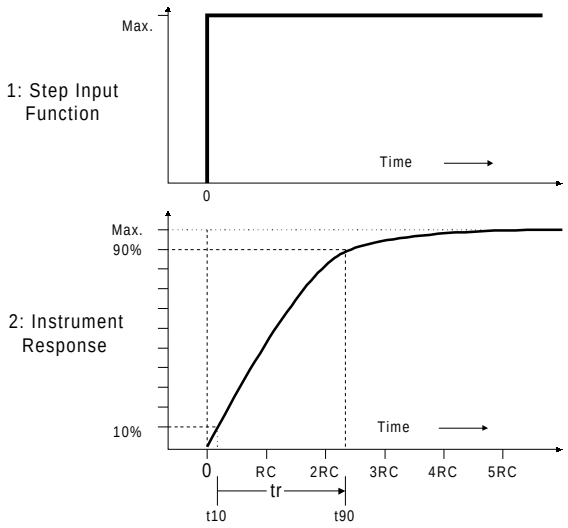

Figure 1-2. Instrument Response To Step Input.

The SM25 has a Default delay Enable/Disable function that allows the users to enable or disable the default delay according to their application needs. For small current measurement an adequate delay is necessary. When the SM25 is operating in the AUTO Measure mode, the default delay is automatically added into the SDM cycle. When a suitable range is selected, the SM25 will follow the Default Delay Enable/Disable setup. The default delay time of SM25 is shown as Table 1-2

The time duration of the "measure" on Fig1-1 is dependent on the selection of the integral rate. All of the integral rates are listed in table 1-3.

Table 1-2. The Default Delay Values of Different Ranges.

Range Source or Measure	1 µA	10 µA	100 µA	1 mA	10 mA	100 mA	1 A
Default Delay (ms)	4	1.5	0.5	0.5	0.5	0.5	0.5

Table 1-3. The Time Duration of Different Integration Rates.

Rate	Fast	Normal	Slow (60 Hz)	Slow (50 Hz)
Time	0.1	2	16.67	20

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1.7.4 Operating Boundaries

While operating in the source-voltage function, 5V is adequate for most digital circuits, while the 25V range will satisfy many analog circuit applications. Due to heat dissipation and size, the maximum power of the SM25 should be limited to 62W/channel.

These constraints will make the module compatible with any medium or high power VXI chassis. The proposed operating quadrant is as shown in Fig 1-3.

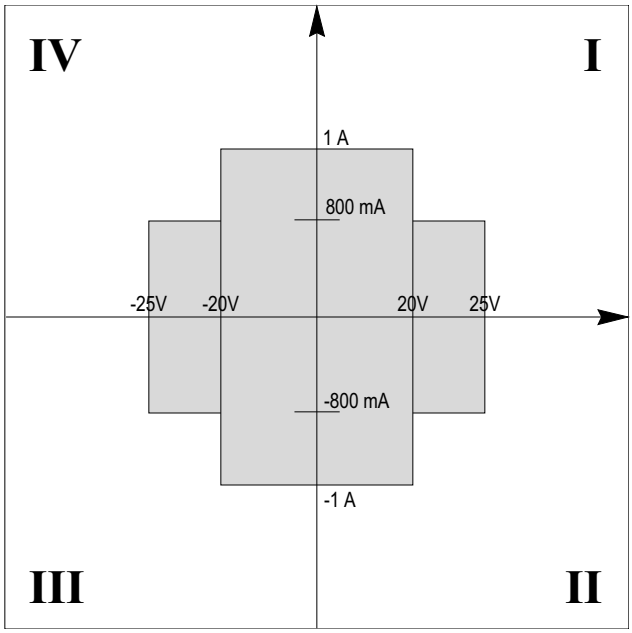

Figure 1-3. Operating Boundaries of The SM25.

The source voltage and current specifications of SM25 are 1A@20V and 0.8A@25V per channel. To support higher current boundaries, the SM25 will allow channels to be connected in parallel.

When operating in the first or third quadrant, the SM25 is operating as a source, that is, the SM25 is delivering power to the load. When operating in the second or fourth quadrant, the SM25 is operating as a sink. It is dissipating power rather than sourcing it. An external source or an energy storage device, such as a capacitor or a battery, can force operation in the sink region. For example, if a 12V battery is connected to the SM25 that is programmed for +10v, the SM25 will operate in the fourth quadrant (source +V and measure –I).

The operating boundaries for a single quadrant of source I measure V are shown as Fig 1-4.

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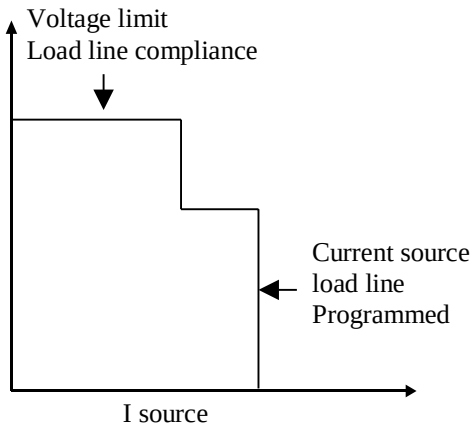

Figure 1-4.

The voltage limit load line represents the programmed compliance limit set by the user. The current source load line represents the source current programmed by the user. These load lines are boundary lines defining the operating limits of the SM25. Boundaries for the other three quadrants source V measure I are similar to Fig 1-5.

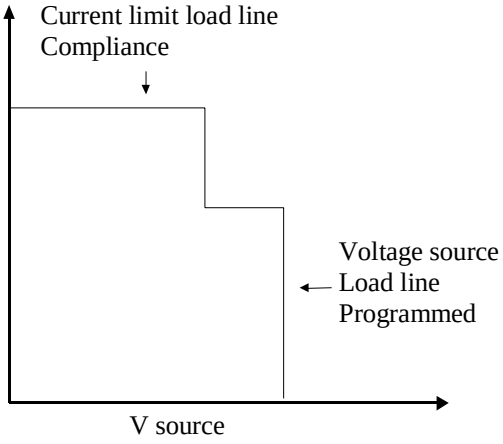

Figure 1-5.

1.7.5 Basic Circuit Configurations

As describe above, the SM25 has four fundamental operating modes.

Mode 1. Source I / Measure V
Mode 2. Source V / Measure I
Mode 3. Measure V only (as a V meter)
Mode 4. Measure I only (as a I meter)

These four modes are introduced below.

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1.7.5.1 Source I Measure V

The equivalent circuit for the Source I Measure V mode of the SM25 is shown in Fig 1-6; a voltmeter (VMETER) connected in parallel with the current source (ISOURCE). In this configuration, the SM25 will function as a high-impedance current source with voltage measure (and limit) capability.

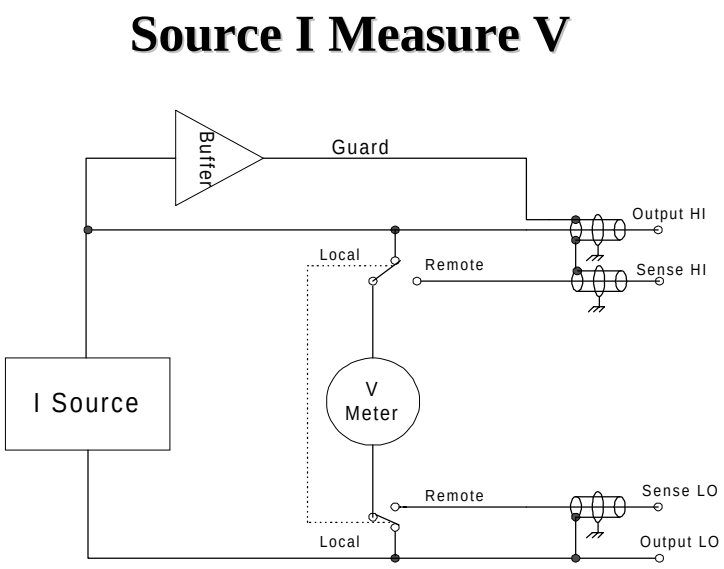

Figure 1-6.

Sense selection (local or remote) determines where the voltage measurement is made. In local sense, the voltage is measured at the output of the SM25. In remote sense, the voltage is measured at the DUT. This compensates for any voltage drops that may be in the test leads or connections between the SM25 and the DUT.

The driven guard is needed to accurately source the low currents that are generated by the internal buffer circuit. The buffer ensures that GUARD and OUTPUT HI always remain at the same potential. Proper use of GUARD virtually eliminates leakage paths in the cable, test fixture and connectors.

1.7.5.2 Source V Measure I

The equivalent circuit of the SM25 Source V measure I mode is shown in Fig 1-7; an ammeter (IMETER) connected between the voltage source (VSOURCE) and OUTPUT HI. In this configuration, the SM25 will function as a low-impedance voltage source with current measure (and limit) capability.

Sense circuitry is used to constantly monitor the output voltage and make adjustments to VSOURCE as needed. VMETER measures the voltage at the output (local sense) or at the DUT (remote sense) and compares it to the programmed voltage level. If the sensed (measured) level and the pro-

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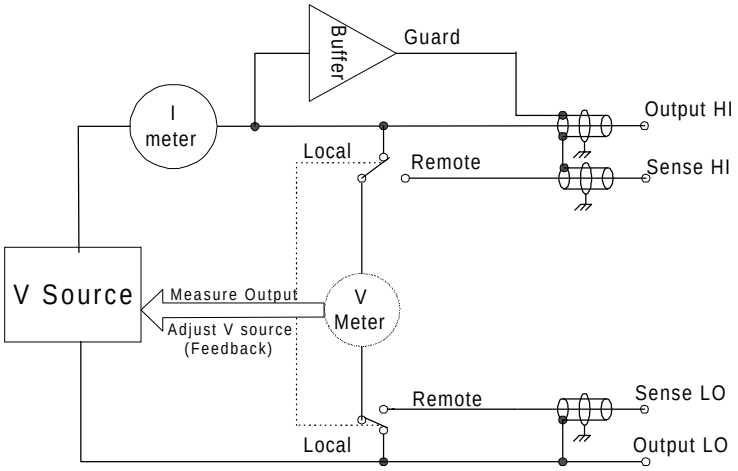

Figure 1-7.

grammed value are not the same, VSOURCE is adjusted accordingly. Here again, remote sense eliminates the effect of voltage drops in the test leads ensuring that the exact programmed voltage appears at the DUT.

The driven guard is needed to accurately measure low current levels in a circuit. GUARD and OUTPUT HI will always be at the same potential.

1.7.5.3 Measure Only (V or I)

Fig 1-8 shows the configuration for using the SM25 exclusively as a voltmeter or ammeter. As shown, the SM25 is configured to measure voltage only by setting it to source 0A and measure voltage.

In Fig 1-8, the Source Meter is configured to measure current-only by setting it to source 0V and measure current. Note that in order to obtain positive (+) readings, conventional current must flow from IN/OUT HI to LO.

CAUTION: V-Compliance must be set to a level that is higher than the measured voltage. Otherwise, excessive current will flow into the SM25 This current could damage the SM25. Also, when connecting an external voltage to the I-Source, set the output off state to the high-impedance mode.

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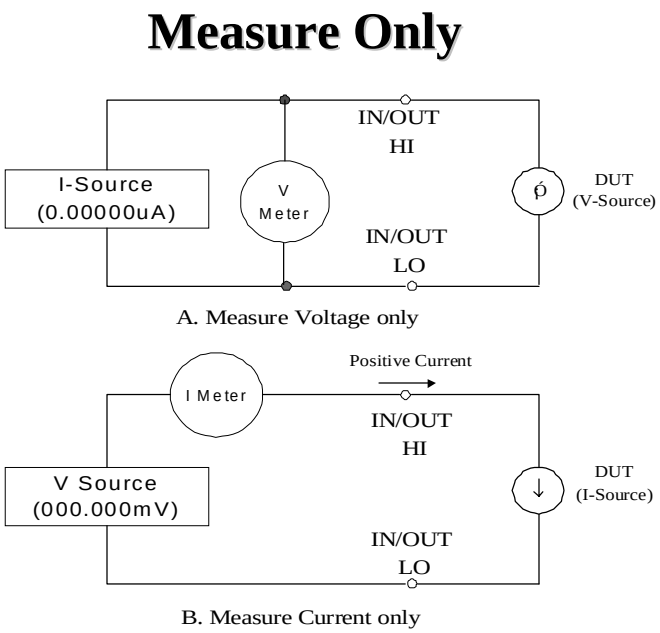

Figure 1-8.

1.7.6 Guard

The purpose of guarding is to eliminate the effects of leakage current (and capacitance) that exists between output high and output low. In the absence of a driven guard, leakage may degrade the performance of the SM25.

Effective guarding is achieved by surrounding the output high signal with a driven guard. Since the voltage potentials of the output high and the driven guard are the same, virtually no leakage current can flow from output high to output low.

The SM25 provides a driven guard for OUTPUT HI and SENSE HI. The driven guard can be enabled or disabled. When the SM25 is properly connected to a test fixture, guard is extended to that test fixture. Thus, leakage in the connecting cables is virtually eliminated. Inside the test fixture, coaxial cables can be used to extend guard all the way to the DUT.

Guard should always be used when sourcing or measuring low current or for high-speed measurements.

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WARNING!

GUARD is at the same potential as OUTPUT HI. Thus if lethal voltages are present at OUTPUT HI, they are also present at GUARD.

1.8 Default Settings

When the user powers on the VXI Mainframe, the SM25 module will automatically set the internal parameters to the default condition. The default states of the SM25 are shown as follows:

1. Force V Measure I Operating Mode.
2. Fixed Source Mode.
3. Source Waveform Shape Continuous
4. Block Data Transfer Function Disabled
5. Force Value 0.1 V
6. 1uA Compliance Setting.
7. Hardware Switches Setting: 25 V Range 1uA Range
8. Local Voltage Sense
9. Local Ground
10. Guard Function Enabled
11. Output Fixed Mode
12. Output Switch Control : Auto
13. Output Switch Off
14. Guard Switch On
15. Local Sense
16. Local Ground
17. Default Delay Time Enabled
18. Slow (60Hz) Integration Speed
19. Ton Time 20 ms, Toff Time 20ms.
20. 1 measurement reading and 1 Average
21. Window Compare Function Disabled
22. Bias Function Disabled
23. Trigger In Disabled, Trigger Out Disabled.

1.9 Data Display

The contents of the internal memory may be accessed via the VXI bus or displayed in several formats using the soft-front panel controls. Source and measure values may be displayed simultaneously, or with the index value. Delay and elapsed time may also be displayed with the index. The choice between display modes is conveniently made using the soft-front panel controls. The delay time between source and measurement may be independently set from 0 to 65535 ms from the soft-front panel or the VXI interface.

1.10 Selectable Sweeps of Voltage and Current

The SM25 can easily be programmed to perform source-measurements as a function of a stepped voltage or current. Voltage and current may be swept linearly, logarithmically, or pulsed. The START, STOP, STEP method of setting sweep parameters allows the operator to become proficient at using the instrument very quickly.

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The SM25 provides a memory for each channel to store up to 255 step conditions. Once this information is loaded, the SM25 can be set to sequence through these settings, automatically adjusting the output levels and making the measurement. The feature works much like an arbitrary waveform generator (AWG), allowing either voltage or current to be varied over time in a precise manner. This feature operates at much slower speeds than a conventional AWG to allow for signal settling and measurement time.

1.11 Trigger

The SM25 can both accept and source triggers on the VXI bus. This allows the SM25 to be tightly integrated with other instruments in the VXI mainframe for improved performance. A channel can be setup to accept one or multiple input triggers, and then execute a defined sweep pattern for each trigger received. It can also be programmed to output a trigger at the completion of the sweep, or for each step in the sweep process. Complex sequences of events can be defined, and then executed without host interaction. Automating this process relieves the host from having to control every aspect of the test process, reducing software overhead and further improves throughput.

The trigger output latency is less than 10us and the trigger input latency is less than 54us. See Fig 1-9.

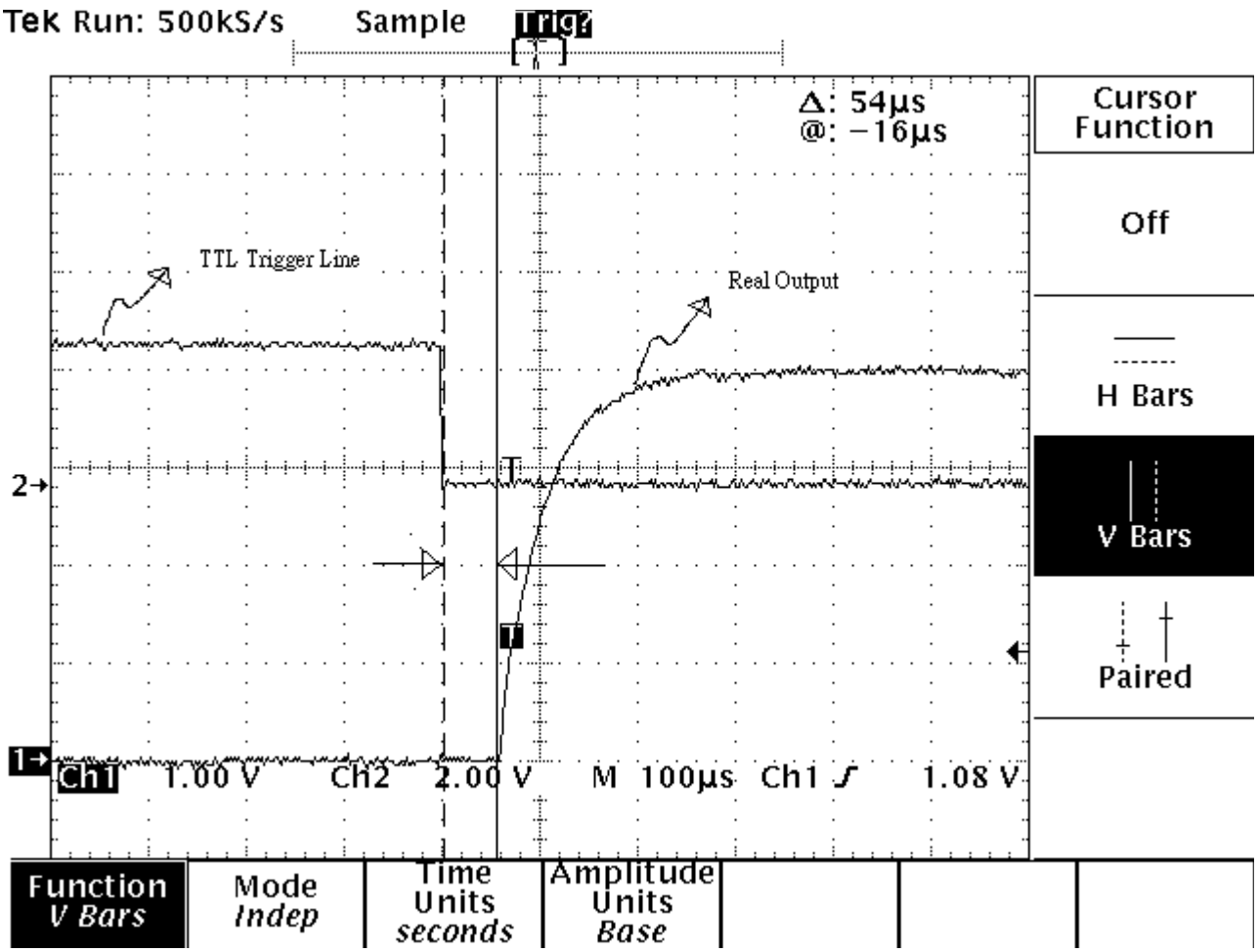

Figure 1-9. Input Trigger Latency

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Input:

Receipt of an external trigger input starts a sweep or sampling measurement, or can be used as a trigger input for continuing a testing program.

The SM25 can accept the trigger line signal from any of the TTLTRG0~TTLTRG7 lines. Both channels can have their own independent trigger source. The channel is triggered by an active low pulse with a minimum width of 50ns. The trigger mode can be set to continuous or to count by a defined number. If the SM25 is set to "continuous", the channel will be triggered continuously – once for each trigger received. If set to "count", the channel will accept only the defined number of triggers and will not respond to additional triggers. The maximum number for "count" is 255. A count value can also be applied to to the trigger input signal. For example, if the user sets the count value to 3, then the channel will be triggered after 3 trigger inputs. Please refer to figure 1-10a.

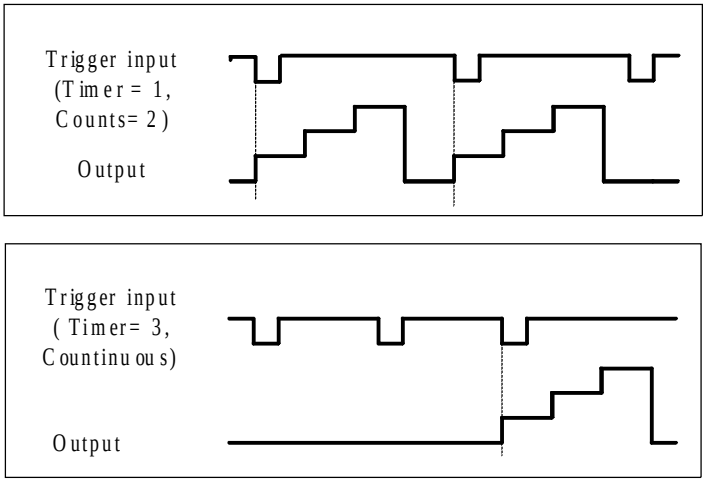

Figure 1-10a.

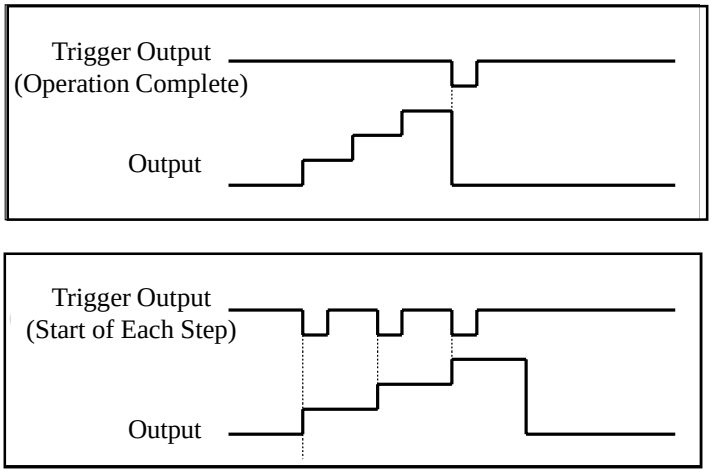

Figure 1-10b.

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Output:

Users can set different trigger output conditions as follows:

(1) **Start of step**: Trigger is generated at the start of each step. Please refer to Fig 1-10b.

(2) **End of Step**: Similar to above but the trigger is generated at the end of each step.

(3) **Start of Operation**: Trigger is generated when the operation starts.

(4) **End of Operation:** Similar to (3) but the trigger is output after the operation completes. Please refer to Fig 1-10b.

(5) **Compare Passed:** Output a pulse after each compare pass.

(6) **Compared Failed:** Output a pulse after each compare fail.

There are two different output polarities that can be selected, high pulse and low pulse. Any time the trigger output condition is met, the SM25 will generate a 100 µs duration high or low pulse on the selected TTL trigger line. This signal can be used to synchronize the operation of other instruments.

Caution:

Channel 1 & 2 of the SM25 can be set to drive different trigger lines, but only one polarity can be selected. In other words, both channels have the same output polarity. This prevents conflict if both channels are set to the same trigger output line.

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1.12 Guarding, Shielding and Sensing

1.12.1 Guarding

The SM25 provides a driven guard for OUTPUT HI and SENSE HI. The basic guarded configurations are shown in Fig1-11. The driven guard is always enabled and thus, always available at the front panel of the SM25. The guard potential is connected to the inner shells of the Triax connectors that surround OUTPUT HI and SENSE HI (guarded Triax Cable configurations are shown in Fig1-12). Since the voltage potential on the inner shells and center conductors are the same, virtually no leakage current can flow from OUTPUT HI or SENSE HI to low, and the capacitance effects of the Triax cable are reduced. Guard should always be used when sourcing or measuring low current.

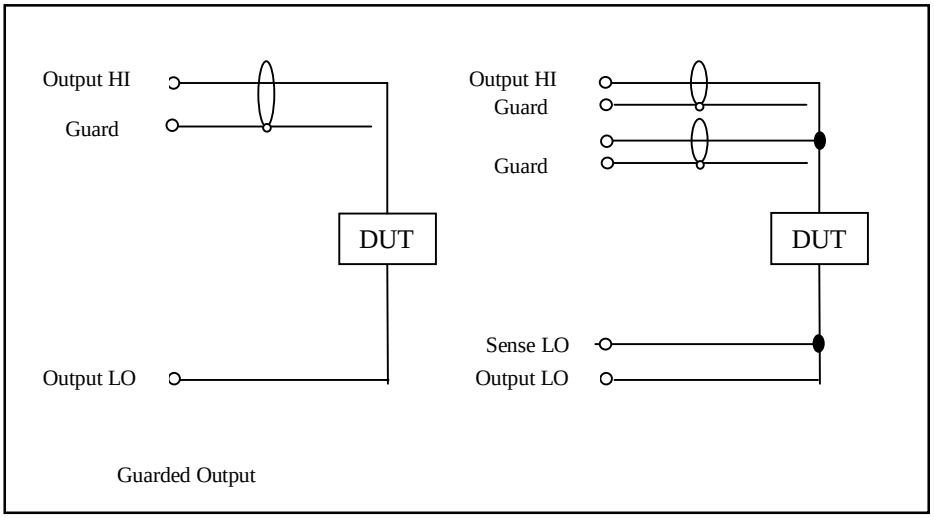

Figure 1-11. Guarded Configuration.

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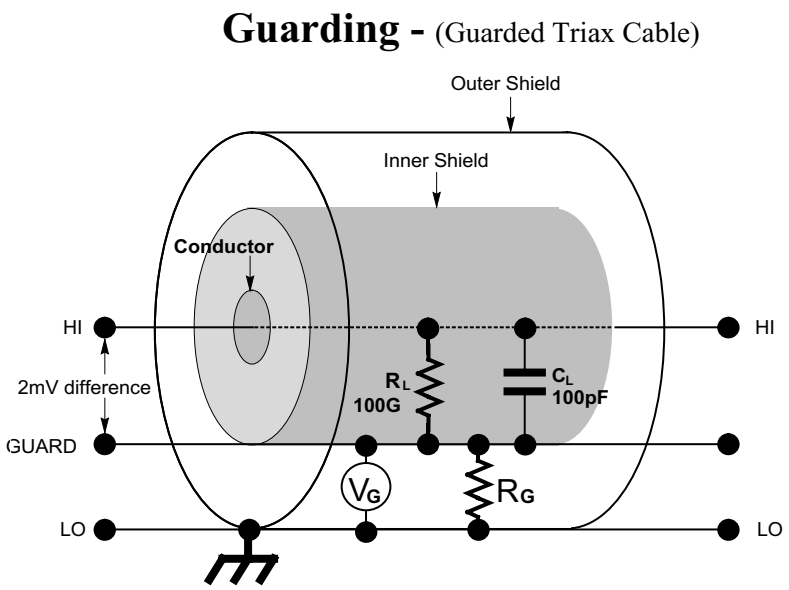

Figure 1-12. Guarded Triax Cable Configuration.

1.12.2 Shielding

Shielding for the DUT must be provided. Without proper shielding, surrounding electric fields can induce noise into the test circuit resulting in erratic and noisy measurements. The SM25 is a VXI based product. Optimum shielding is achieved by connecting the module enclosure to the chassis ground when the module is installed in the mainframe.

1.12.3 Sensing

The SM25 has local or remote sensing capability. When The SM25 is programmed to source V, sensing provides a feedback voltage that is measured and compared to the programmed voltage level (show as Fig 1-7). If the feedback voltage is more or less than the programmed voltage level, then the voltage source is decreased or increased, respectively, until the feedback voltage equals the programmed voltage level.

In local sense mode, sensing is performed at the output of the SM25. In remote sense mode, external sense leads are connected to the load. Thus, sensing is performed at the load. Remote sensing compensates for test lead IR drop, ensuring that the programmed voltage level is delivered to the load.

When sourcing I, local sensing is used to measure voltage at the output terminals. (Show as Fig 1-6) In remote sensing, external sense connections are made across the load. Thus, the subsequent voltage reading is the actual voltage drop across the load. Test lead IR drops are not included in the measured reading.

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1.13 SM25 Setup Sequence

The operation and configuration of the SM25 can be setup by the Soft Front Panel (SFP) interface or by making function calls to the Plug & Play drivers. The Source/Measure VI and extended output functions of SM25, such as appended sweeps and trigger outputs, offer great flexibility in providing an optimal test environment. Normally, the setup sequence of SM25 is shown as Fig 1-13.

The SM25 has a hierarchy to the programming commands. When programming the setup the SM25, the command sequence is not critical if the setup commands are at the same level. But if the setup commands are at a different level, any change of the upper level command may impact the lower level's command setup.

For Example, when the SM25 is set to the FVMI mode, the compliance setup will function automatically on the current (I). Another example is when the SM25 is set in DC output mode, the waveform setting can't be in the discontinuous mode. When the range of the SM25 is selected, the maximum value of the output is limit by the range. The details of the SM25 setup are further described below.

1.13.1 Operating Mode

The SM25 can both source and measure at the same time. The steps for setting the operating mode from the SFP are:

1. Click the "**Setup**" button on the bottom of the soft front panel.
2. Select the "**Function**" tab from the pop-up window.
3. Choose the Source V, Measure I or Source I Measure V mode.

If you want the SM25 to operate in a "Measure only" mode, you can set the Source value to 0.

1.13.2 Output Mode

The SM25 supports four types of waveform output. They are "**DC**", "**Fixed**", "**Sweep**" (linear or logarithmic) and "**Append**". The details of the setup procedure are discussed in chapter 2. The steps for selecting the output mode are:

1. Click the "**Setup**" button on the bottom of the SFP.
2. Select the "**Function**" tab from the pop-up window.
3. Select the desired output mode from the drop-down list.

Caution: When the SM25 is setup in the DC output mode, only the continuous waveform option is valid. If the "shape" parameter is changed to pulse, then the mode is automatically changed to fixed, and the DC mode is unavailable.

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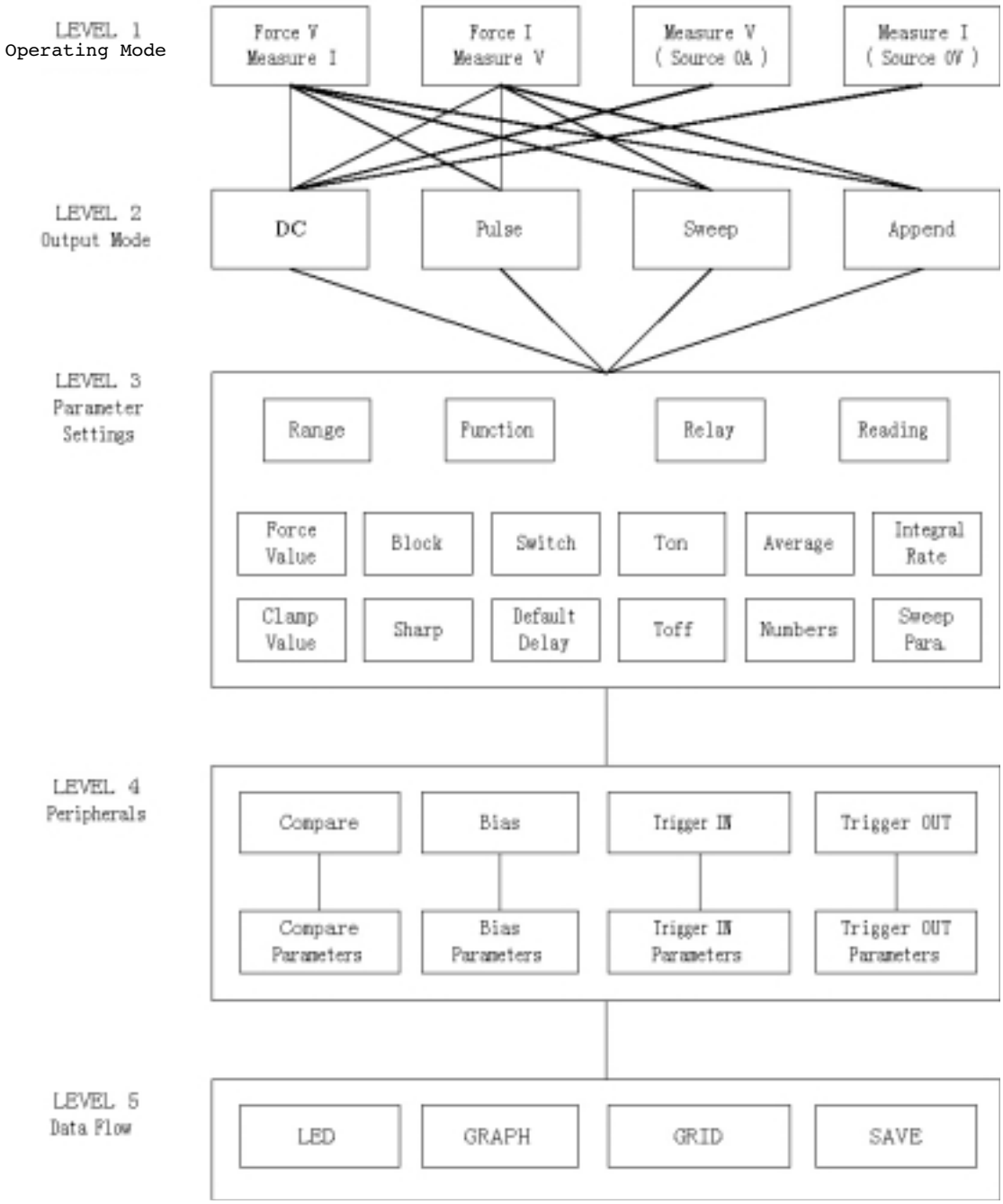

Figure 1-13. The Setup Level of SM25.

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1.13.3 Voltage and Current

1. When the selection of the output mode is completed, the next step is to select the source range. The measurement accuracy will be determined once the source range is selected. At this time, the SM25 will automatically check if the input value is within the selected range.

   If the SM25 is set to the "Auto Range" function, then the SM25 will automatically select the most suitable range for the DUT. When the best range is selected, the user can change from "auto" range to "fixed" range to obtain faster measurements.

1.13.4 Relay Settings

The relay setup of SM25 is very flexible. The user can configure the relays to the appropriate setting for each application. The selection of the relay setup is as follows:

A. Click the "setup" button on the bottom of the SFP and select the "Relay" tab.

B. The five switch setting options are described as follows:

   1. **SW Auto**: In some applications, the output switch of the SM25 does not need to open after the SM25 completes a measurement. Maintaining the connection will speed up the measurement process and reduce noise caused by the switch turning On/Off. The "Auto" mode will automatically open the output switch after all measurements are complete. The "Manual" mode will allow the user to decide if the output switch is left "On" or "Off" after measurement.

   2. **Out SW:** The users can use this option to decide if the output switch is "On" or "Off" after measurement, depending on the state of the SW Auto parameter. If SW Auto is set to "Manual", then the state of the Out SW parameter determines the state of the switch after all measurements are complete.

   3. **Guard:** For small signal measurements, the "Guard" function is suggested to minimize the impact of cable leakage on the measurement.

   4. **Sense:** The Sense option allows you to select 4-wire measurement and reduce the cable impedance effects.

   5. **GND:** The GND sense option allows you to select 4-wire measurement and reduce the cable impedance effects.

1.13.5 Parameter Settings

For any Source/Measure cycle of the SM25, the user should configure the source waveform characteristics to provide appropriate stimulation to the DUT. The SM25 will execute the configured source/measure program, record the measured data and complete the process. The process of configuring the output waveform and the measurement method are introduced in Chapter 2.3.

The SM25 supports an averaging function that will average together from 1~255 measurements. The actual number of pulses that are output to the DUT, assuming the shape is not continuous, is shown in Figure 1-14.

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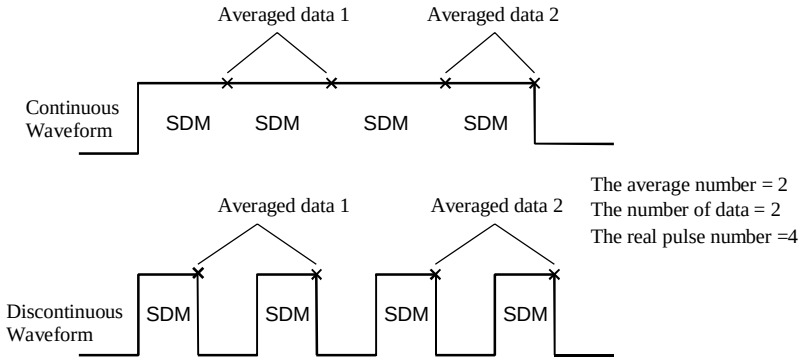

Figure 1-14. The Pulse Number of a Measurement.

For setting the integral rate option, the "Fast" setting will configure the SM25 to acquire one measurement in 100usec. The "Normal" setting will configure the SM25 to acquire a measurement in 2msec and functions like a 500 Hz digital filter. The "Slow" option will configure the SM25 to make a measurement in 16.67ms or 20ms, operating like a 60Hz digital filter or a 50Hz digital filter, respectively. See Table 1-3.

1.13.6 Peripherals

In addition to the basic Source/Measure capability, the SM25 also provides several peripheral functions, like setting bias levels, window compare and trigger In/Out. The relative characteristics and applied timing of these peripheral functions are as follows:

1. Bias: The bias is used to change the output reference level. The bias also provides a pre-warm-up function. The bias level of the SM25 can be positive or negative. Care should be taken that the bias level remain within the output setting range. Examples of the bias function are shown in Fig 1-15.

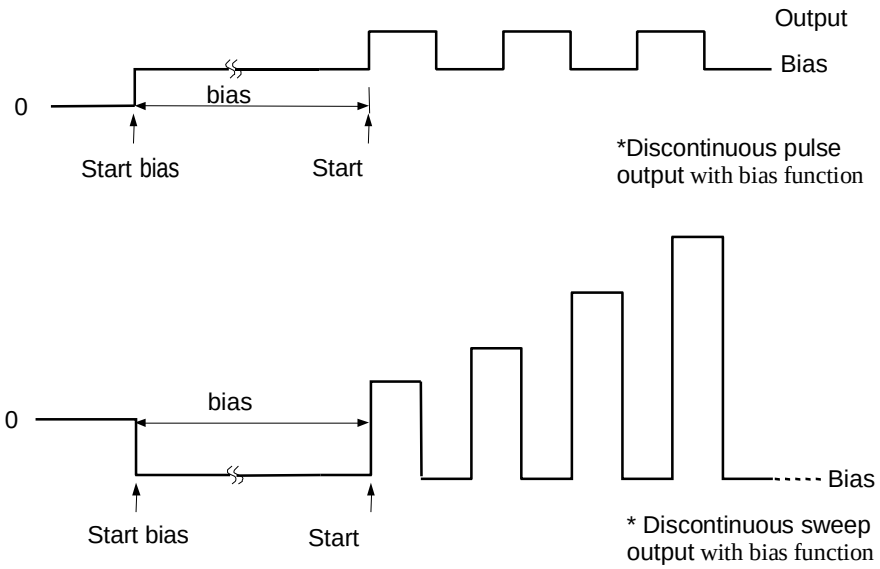

Figure 1-15. The Bias Function of Pulse and Sweep Output.

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The parameters for the bias function include "bias time" and "bias level". The "bias time" (pre-heat time) can be set from 0msec to 2^{31}ms.

2. Window Compare: When the SM25 is executing a source/ measure operation, the SM25 performs a window compare function for each cycle. Users can define an acceptable upper and lower range for this operation and the SM25 will auto compare the measurement result to the range. When the measurement result are within the acceptable range, the SM25 will report the measured data as "**pass**". When the measurement result is outside the acceptable range, the SM25 will report the measured data as "**fail**". The compared results (pass or fail) will be shown in the data reports of SM25. Care should be taken that the upper range limit is larger than the lower limit. Otherwise the results will be meaningless.

   The Window Compare Test function is a standard feature of the SM25. The function can be set to either on or off and will not impact the normal Source/Measure operation in either setting. The setup process is shown in Chapter 2. When the SM25 module is integrated and operating with other instruments, the SM25 can use the Window Compare result (Pass or Failed) to generate an output trigger to the system for other instruments.

3. Trigger In/Out: When the SM25 module is operating in a test system, the trigger in and trigger out function allows the user to synchronize the SM25 to other instruments within the system. The details setup sequence is discussed in Chapter 2.

1.13.7 Data Flow

The SM25 module has two data transfer modes, they are register mode and FIFO mode. The differences between these two modes are described as follows:

The Register Mode:

Advantage: Access Voltage/Current measured result in real time.

Weakness: The throughput speed of measurements are slower than FIFO mode (due to handshaking with DSP).

The FIFO Mode:

Advantage: Test throughput is very high.

Weakness: Access of the measured results cannot be performed in real time.

The display modes of the SM25 SFP are LED, Graph and Grid. The detailed configurations are discussed in Chapter 2.

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1.14 DC Mode Operation

When the SM25 is configured in DC output mode, the SM25 functions like a Voltage/Current power supply. If the output value is with the output range setting, the SM25 can rise to the programmed output level very quickly. This assumes that the 5RC time factor (default delay) is short. The delay and measurement averaging settings can still be determined by the user. The measurement speed will be the fastest when the user sets the Ton time to 0ms. The user should be aware that the accuracy of transient measurement is degraded if the default delay is shortened to less than the default settings. The output waveform of DC output mode is shown in Figure 1-16.

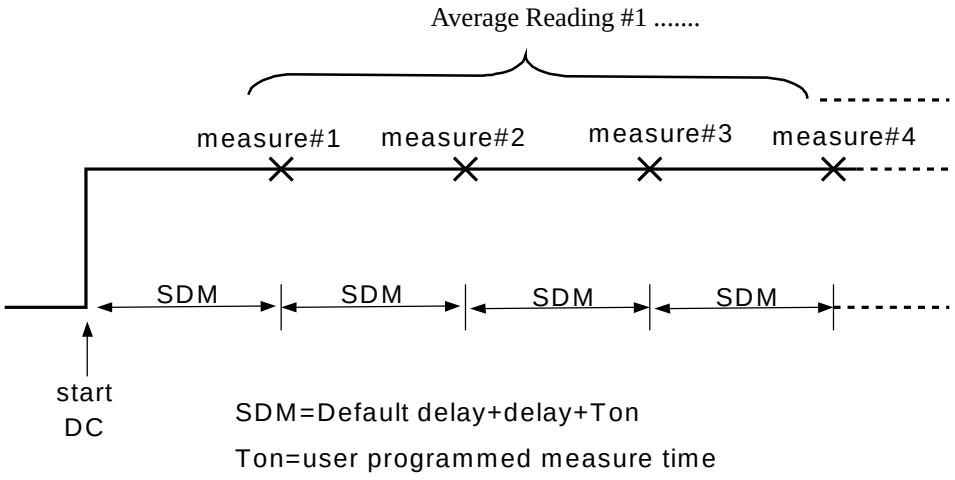

Figure 1-16 The Output Waveform of DC Mode.

1.15 Fixed Mode Operation

The SM25 can output current pulses up to 1A at 20V or voltage pulses up to 25V at 0.8 A. The polarity of the pulse output can be positive or negative. While in the fixed source mode, the output will alternate between the set pulse level and either the bias value or zero (0V or 0A).

A pulse reading is only performed while the output is on. When the output is set to off (bias or 0), a reading is not performed.

The output waveform shape of the SM25 supports continuous and pulse formats. The continuous characteristics are shown in Figure 1-17 and looks like the DC mode with finite measurements. The pulse characteristics are shown in Figure 1-18. For any cycle while in the pulse mode, the duty cycle is calculated as follows:

$$Duty\ Cycle = SDMon / SDMoff = \frac{Default\ Delay + Delay + Ton}{Default\ Delay + Delay + Toff}$$

Where:

$SDMon = DefaultDelay + Ton + Integration\ Time$

$SDMoff = DefaultDelay + Toff + Integration\ Time$

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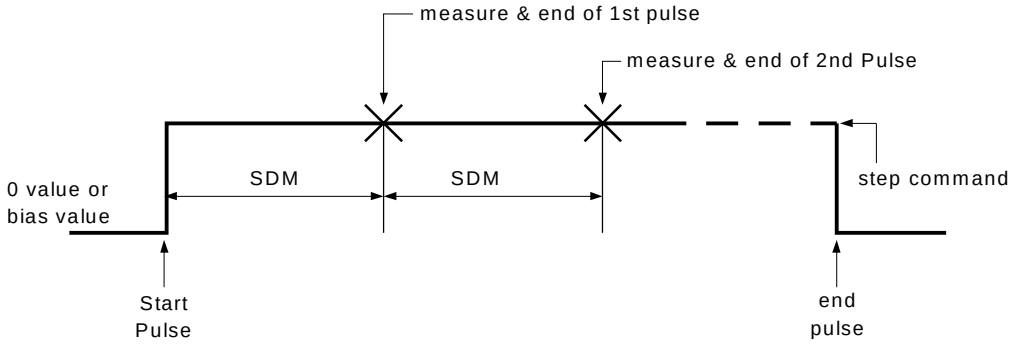

Figure 1-17 The Output Waveform of Continuous Pulse Mode.

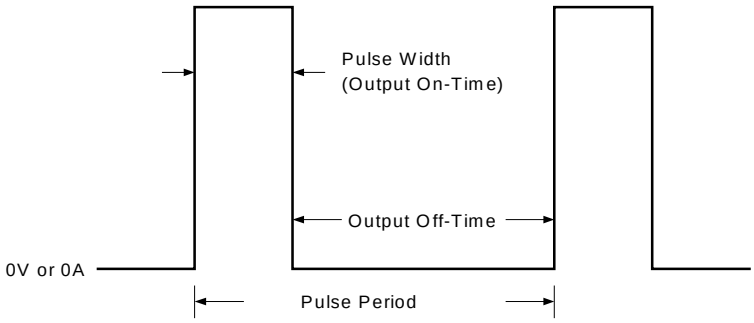

Figure 1-18. The Output Waveform of Discontinuous Pulse Mode.

The SM25 does not perform measurement operations during the output off time. In the fixed mode with pulsed outputs, users may choose to set up the "trigger in" parameter for the leading edge of the pulse and the "trigger out" setting for the trailing edge of the pulse. This would allow closed-loop synchronization between the SM25 and other instruments.

1.16 Sweep Mode Operation

The sweep function allows the user to program the SM25 to step through specific voltage and current settings and perform measurements at each source value. The SM25 becomes a much more powerful tool when combined with one or more additional Source Measure Units, allowing for more complex test scenarios. The basic steps to perform a sweep are as follows:

1. Define the output mode for the desired sweep waveform.
2. Configure the relative parameters.
3. Configure the peripheral functions.

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4. Start operation.

The waveform shapes "continuous" and "pulse" also apply to the sweep functions. If "pulse" is selected, the user will need define the Ton and Toff time. When a step measurement is complete, the source level will go back to the bias level and hold for Toff time, then the next SDM cycle will start. The two basic sweep waveforms that are available are described as follows.

1.16.1 Linear Staircase Sweep

As shown in Figure1-19, the Linear Sweep mode will sweep the outputs from a start source value to an ending (stop) source value. Programmable parameters include the start level, stop level, the step size, delay, bias level and the source range.

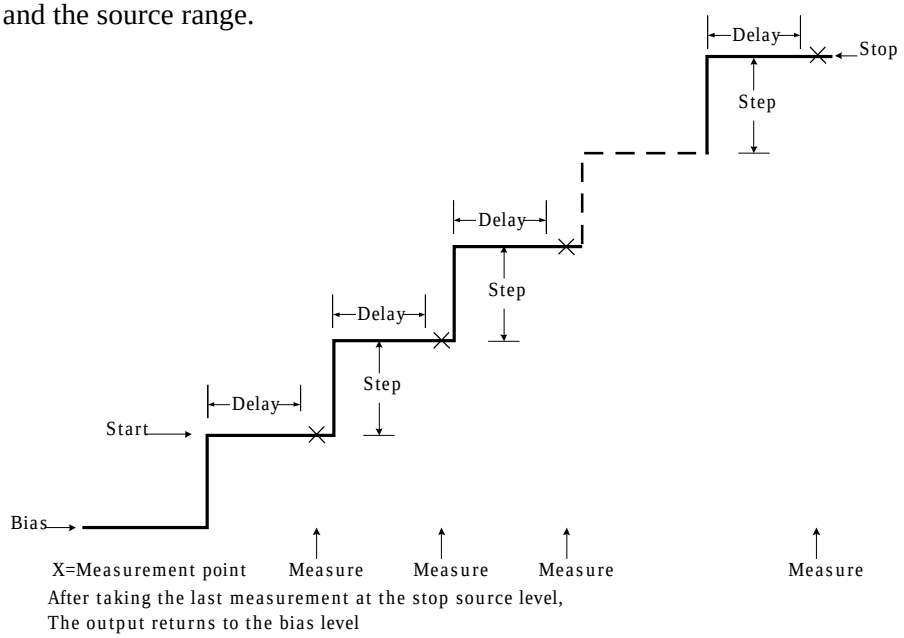

Figure 1-19. The Output Waveform of Linear Staircase Sweep Mode.

When this sweep function is triggered to start, the output will start at the bias level and transition to the start source level. The output will then change in equal steps until the stop source level is reached. The step scale is calculated as follows:

$$StepScale = \frac{StopLevel - StartLevel}{Steps}$$

The time duration at each step is determined by the default delay, the programmed Ton time and the integration setting. Note that the default delay ON/OFF function cannot be changed once a sweep is configured and running. This parameter is the same for all steps in the sweep.

1.16.2 Logarithmic Staircase Sweep

The logarithmic staircase sweep is similar to the linear staircase sweep, except the steps are done on a logarithmic scale - as shown in Figure1-20. As with the staircase sweep, the delay period is the same for all steps.

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The programmable parameters for a log sweep are similar to the linear sweep except there is a scale multiplier, which determines the number of measurement points per decade for the sweep delay.

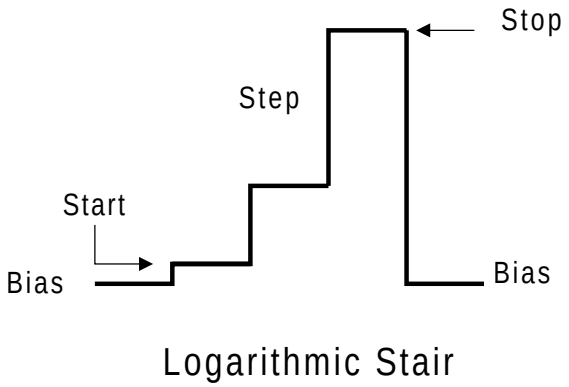

Figure 1-20. The Output Waveform of Logarithmic Staircase Sweep Mode.

When a logarithmic sweep is triggered to start, the output will transition from the bias level to the start source level. The start level and the programmed points/decade (5, 10, 25, or 50 points/decade) determine the step values for the staircase. The SM25 will automatically calculate step values that will provide symmetrical steps (on a log scale) through each source decade – up to the stop source level.

The scale multiplier is calculated from the number of points per decade as follows:

$$LogScale = \sqrt[points]{10}$$

Thus, the four different selections are listed in Table1-4.

Table 1-4. The Scale Multiplier.

Points / Decade	Multiplier
5	1.584893192
10	1.258925412
25	1.096478196
50	1.047128548

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1.17 Append Mode Operation

The Append mode allows the user to program the SM25 to force the output at specific voltage or current levels, and performs measurements at each source value. The waveform shapes "continuous" and "pulse" can also be selected in this mode. The basic steps to perform appended operations are as follows:

1. Define the output mode as append
2. Define the number of append steps
2. Set the append output values
3. Configure the relative parameters
4. Configure the peripheral functions
5. Start operation

For example:

1. Output mode: continuous output
2. The number of steps for Append: 7 steps
3. The append output values: -20V, +8V, -3V, -11V, +1V, +18V, -4V

The output waveform for the above configuration is shown in Fig 1-21. More detailed append operations are described in Chapter 2.

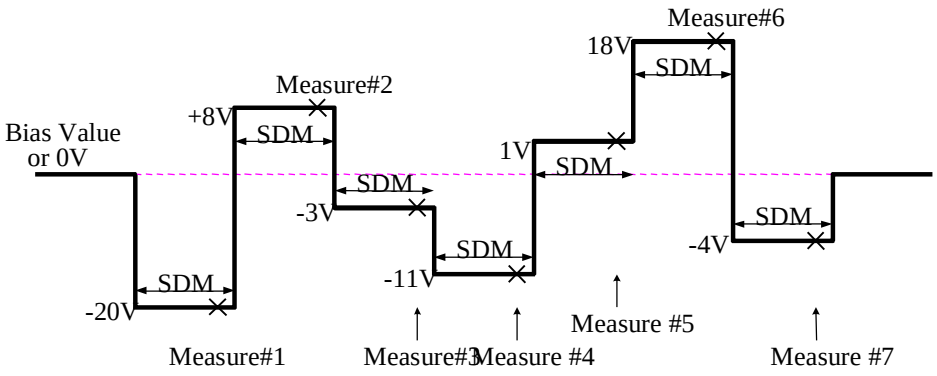

Figure 1-21. The Output Waveform of Appending Mode.

1.18 Wiring Connection

The Source Measure Module can be used with the Interface Technology CTF-1000 Component Test Fixture to provide a safe operating environment and to optimize performance. The operating examples provided are intended for use with the CTF-1000 component test fixture, which can be used with either the SM15 or SM25 Source/Measure Module.

Connections between the SM25 Module and the component test fixture are shown in Figure 1-22. The cable set used for these connections consist of four Triax terminated cable. Notice that all four Triax connectors of the SM25 Module are connected to the component test fixture, extending the guard and remote sense to the fixture.

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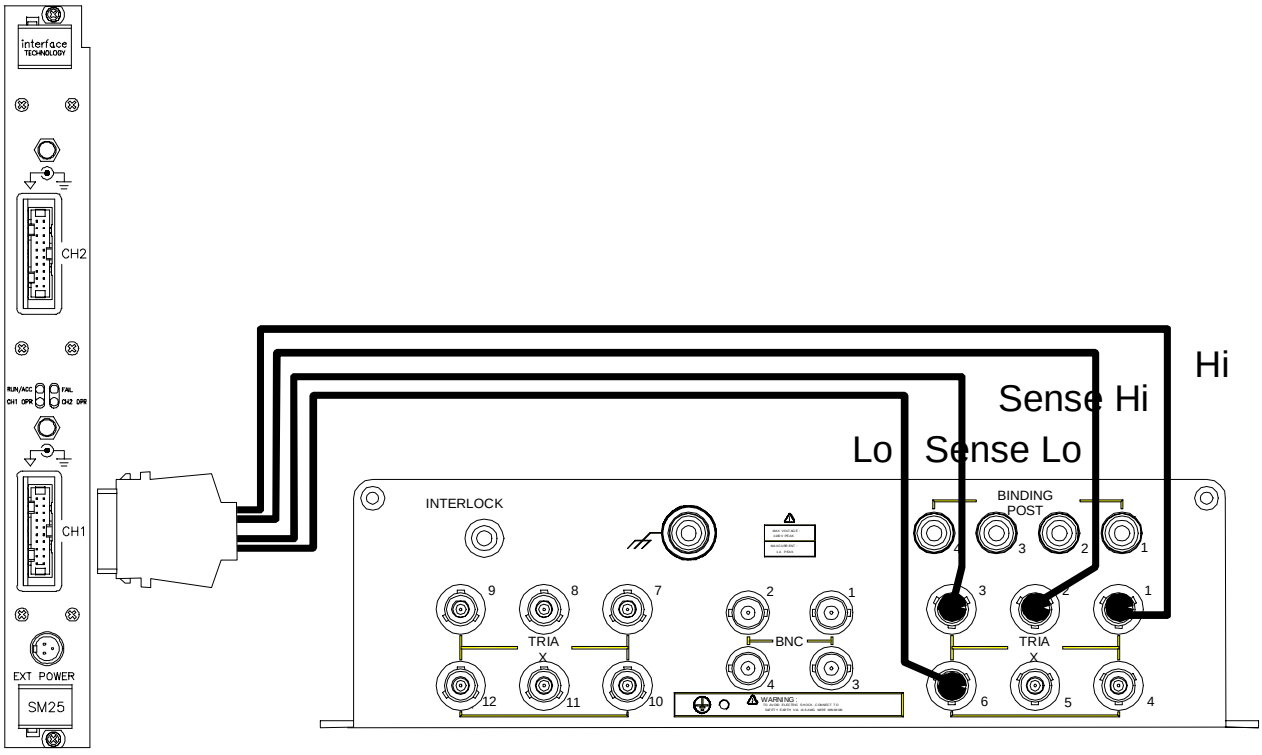

Figure 1-22. Connections Between The SM25 and CTF-1000 Component Test Fixture.

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The detailed configuration for channel 1 and channel 2 connectors is shown in Fig 1-23.

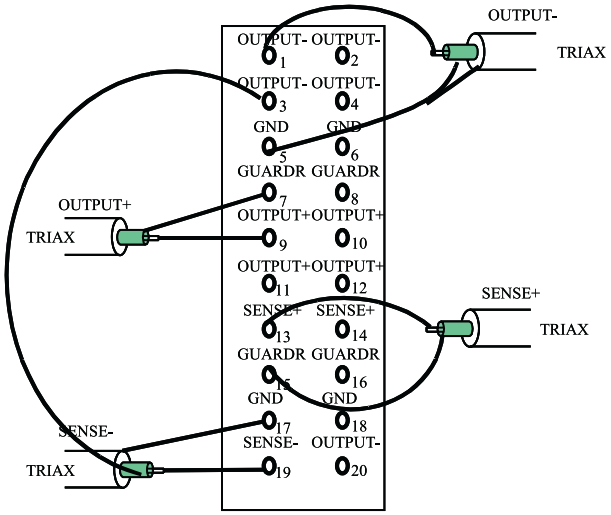

Figure 1-23. The Detail Configuration of Channel 1 and 2.

OUTPUT HI (with GUARD) is a three-lug Triax connector. OUTPUT HI is located on the center conductor and GUARD is located on the inner shell.

SENSE HI (with GUARD) is a three-lug Triax connector. SENSE HI is located on the center conductor and GUARD is located on the inner shell.

SENSE LO is a three-lug Triax connector. SENSE LO is located on the center conductor and OUTPUT LO is located on the inner shell.

OUTPUT LO is a three-lug Triax connector. OUTPUT LO is located on the center conductor and GROUND is located on the inner shell.

In order to obtain optimal results, the SM25 module should be used with a test fixture to house the DUT. The test fixture should provide guarding, shielding and remote sensing for the DUT. All test connections are made at the front panel of the SM25. A detailed description of the SM25 front panel is shown in figure1-24.

The channel 1 and 2 Floating ground and Earth ground connectors are normally open. When users want to connect the floating and earth ground together, they simply put the shorting cup on the connector. The Triax cables can be used to connect channel 1 and channel 2 to the component test fixture, to other fixtures, or to other instruments.

The external power connector is used only in dual channel mode, and only when the combined power of both channels exceed specific parameters. When the SM25 is required to drive two channels, and the output levels exceed the mainframe single slot power specifications, then external power can be connected to the SM25 through the external power connector to supply the extra power required by the SM25.

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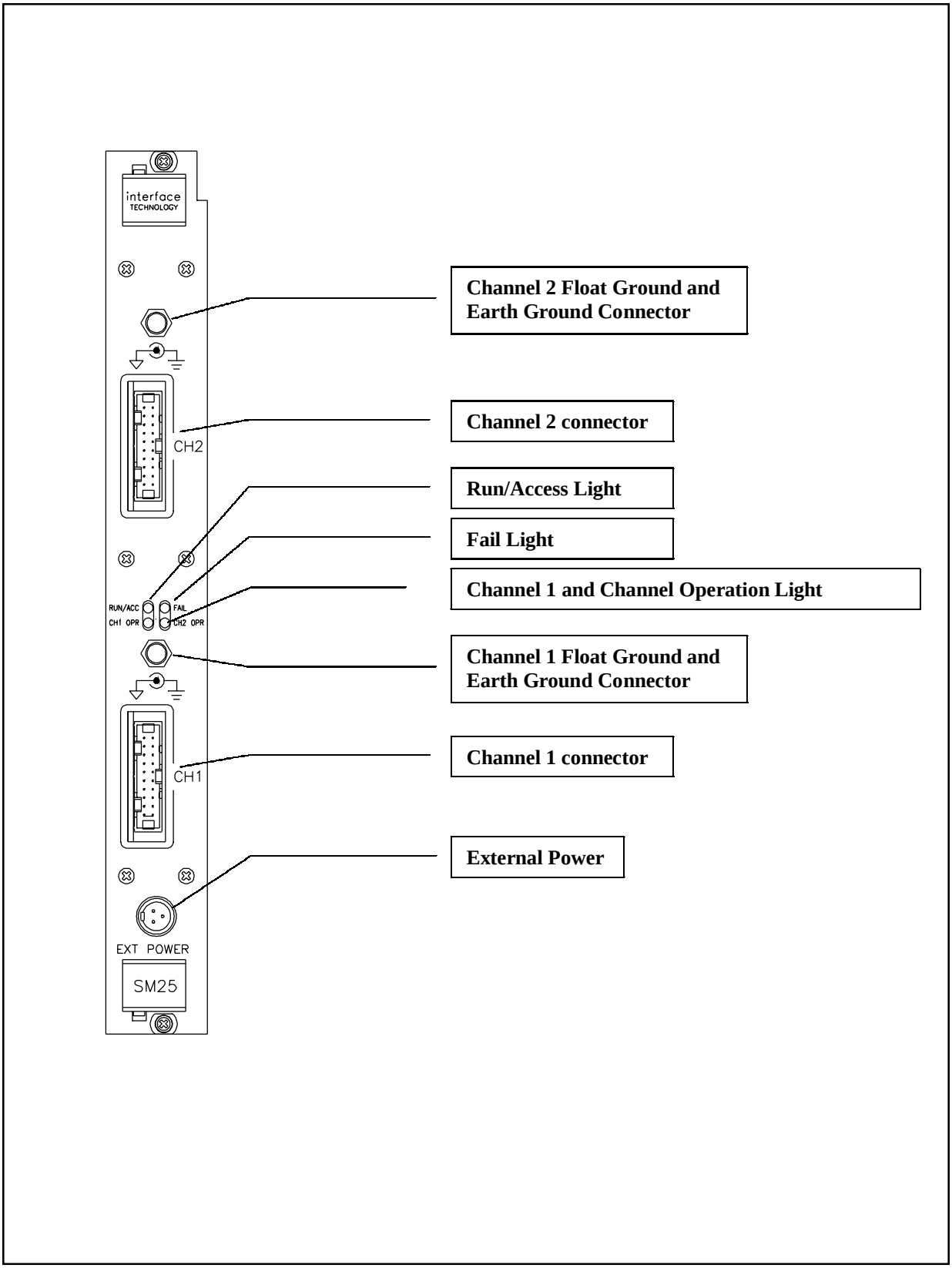

Figure 1-24. SM25 Front Panel.

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1.19 Setting the Module Address Switch

The valid logical addresses for the SM25 are from 1 to 255. Refer to Fig 1-25 for switch position and information.

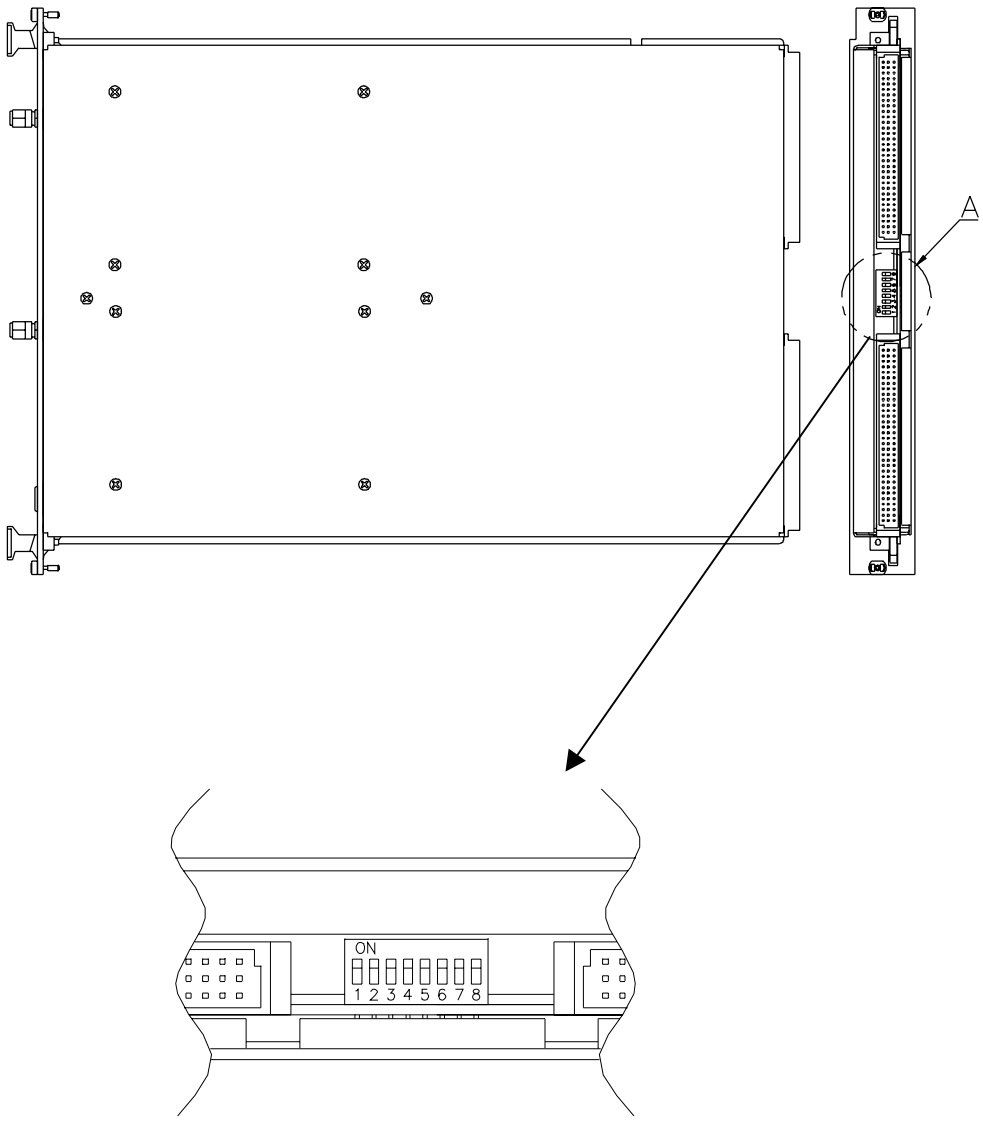

Figure 1-25. Setting The Logical Address Switch of SM25.

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1.20 Block Diagram

As shown in Figure 1-26, the Source Measure Module consists of shared and individual resources for the two channels. The VXI interface is common to both channels. The remaining portions of the block diagram are repeated for each channel, providing a common interface, but independent function and control.

The DSP Controller will decode binary "commands" from the control registers, to configure the working setup of the channel(s). When the DSP controller receives the command code, the DSP module will execute the corresponding operation. The operations include the control of I/O, the A/D converter, the D/A converter, etc.

The typical example defines an output for the control D/A and enables the driver circuit. The sourced signal will pass through the current ranging circuit and sensors to the DUT. At the same time, the Compliance D/A will be set to protect the DUT from over current or over voltage condition.

The current ranging circuit and voltage ranging circuit will amplify or decay the voltage and current of the DUT and send the results to the Current A/D and Voltage A/D circuit. After digitizing, the measurement value will be sent back to DSP controller. The DSP controller will determine if the value matches the programmed output or not. Thus, the Source/Measure Module will constantly adjust its output to the DUT to adjust for systemic variations and provide optimum performance and control during the source/measure process.

Normally, there are some voltage variations between test instruments and the DUT. To protect the integrity of the SM25's measurements from unexpected ground loop noise or voltage, the instrument was designed with a photoelectric insulting circuit to isolate the measurement circuit from the DUT. This is very important to the accuracy of DC measurements.

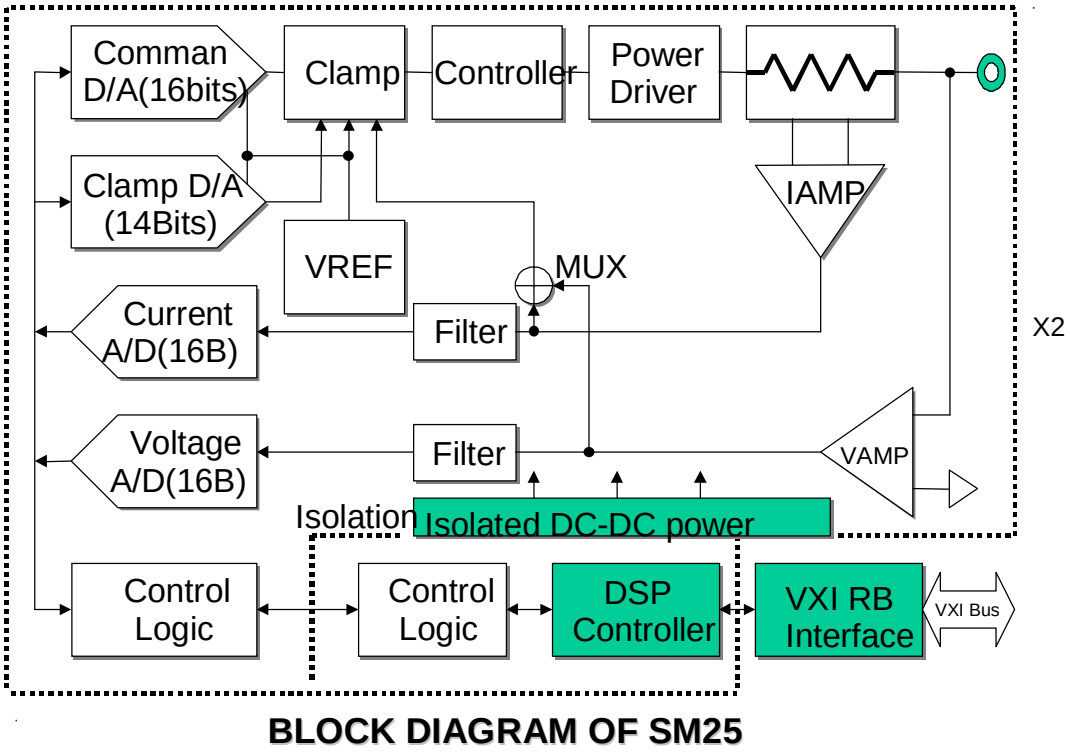

Figure 1-26. Block Diagram of SM25.

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VXI RB Interface: The VXI Register-Base Interface is responsible for communications with the VXI system controller and other instruments.

DSP Controller: Processes commands and performs data communications with the VXI RB Interface via a FIFO, controls the operating mode and parameter settings of the SM25, reads data from the A/D and processes the data, controls the output levels and compliance levels

Control Logic: I/O and range control, ground isolation

Command D/A: Access commands from the DSP to control the hardware output levels.

Clamp D/A: Access commands from DSP to provide the compliance voltage to the clamp circuit.

VREF: Provides a standard voltage reference.

Clamp: 4 quadrant operation - Diode and AMP based design to prevent the DUT and/or SM25 from being damaged. The clamp compares and summarizes the command voltage, compliance voltage and the feedback to determine the output level.

Controller: Summarizes the parameters to provide the best range selection.

Power Driver: Drive the output voltage level and referenced to real ground.

I BANK: Switch the active current range.

I AMP: Amplify the current to the desired level.

V AMP: Switch voltage range and amplify the voltage to the desired level.

Filter: Filter out AC noise.

Current A/D: Acquire digitized current measurements for use in the DSP computations.

Voltage A/D: Acquire digitized voltage measurements for use in the DSP computations.

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1.21 Power Requirements

There are two different configurations for the SM25, single channel and dual channel. Both of these configurations have different power requirements, depending on their settings. Users must calculate the maximum power requirement and make sure that enough power is available from the VXI chassis before plugging the module into the VXI mainframe. Tables 1-5 and 1-6 depict the power and current requirements for each configuration.

Table 1-5. Power and Current Requirements Of A One Channel SM25.

Voltage	Maximum Current	Power
+5 V	1 A	5 W
+12 V	0.25 A	3 W
-12 V	0.25 A	3 W
+24 V	0.16 + (Iout1*0.9)	(0.16 + (Iout1*0.9))*24
-24 V	0.16 + (Iout1*0.9)	(0.16 + (Iout1*0.9))*24

Note: Iout 1 is the absolute maximum output current of channel 1 that the SM25 may source or sink.

For Example:

If an application is to test a load with a 0.5 maximum current, then the current on each power source is:

+5 : 1 A
+12 : 0.25 A
-12 : 0.25 A
+24 : 0.16 A + (0.5 A *0.0) = 0.61 A
-24 : 0.16 A + (0.5 A *0.9) = 0.61 A

You can check these values against the mainframe specifications to determine if it will work properly.

Table 1-6. Power and Current Requirements of a Dual Channel SM25.

Voltage	Maximum Current	Power
+5 V	1 A	5 W
+12 V	0.5 A	6 W
-12 V	0.5 A	6 W
+24 V	0.32 + ((Iout 1+ Iout 2) *0.9)	(0.32 + ((Iout 1+ Iout 2) *0.9))*24
-24 V	0.32 + ((Iout 1+ Iout 2) *0.9)	(0.32 + ((Iout 1+ Iout 2) *0.9))*24

Note:

Iout1 is the absolute maximum source/sink current of channel 1.
Iout2 is the absolute maximum source/sink current of channel 2.

Since the per-slot power of the ±24 V supply in a VXI bus mainframe is limited, the maximum power available for both channels is 48 W at 50 deg C. If the application needs more power, the user must install an external power supply. Refer to the detail diagram in Fig 1-27.

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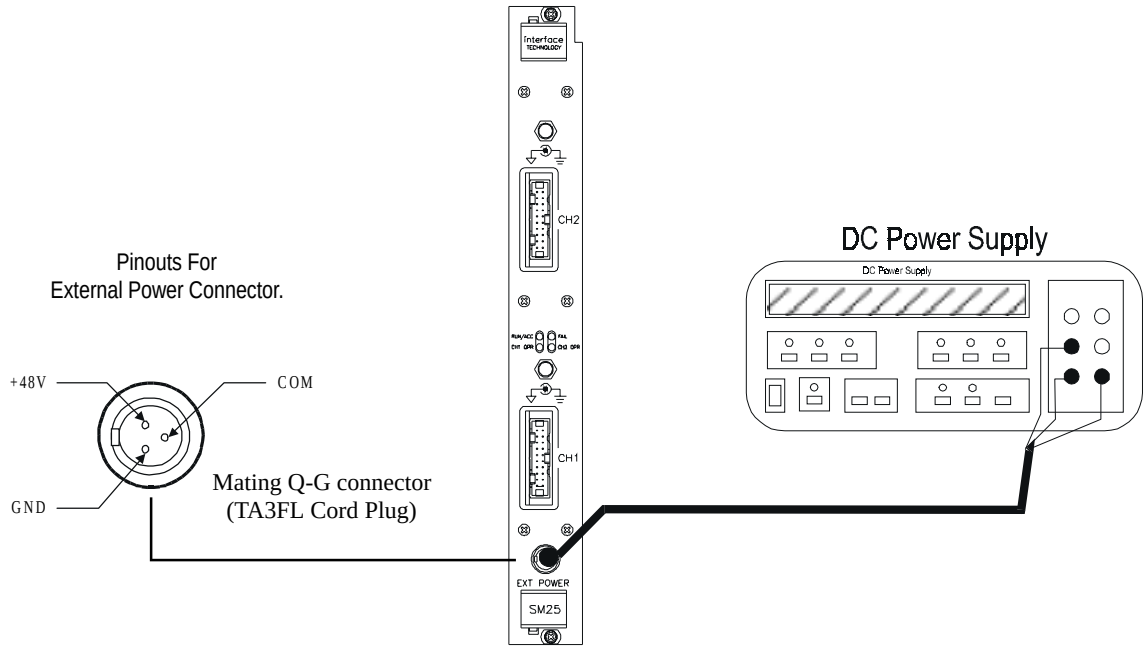

Figure 1-27. External Power Connection.

After connecting an external power supply, you must change the JUMPER configurations as shown in Figure 1-28.

.

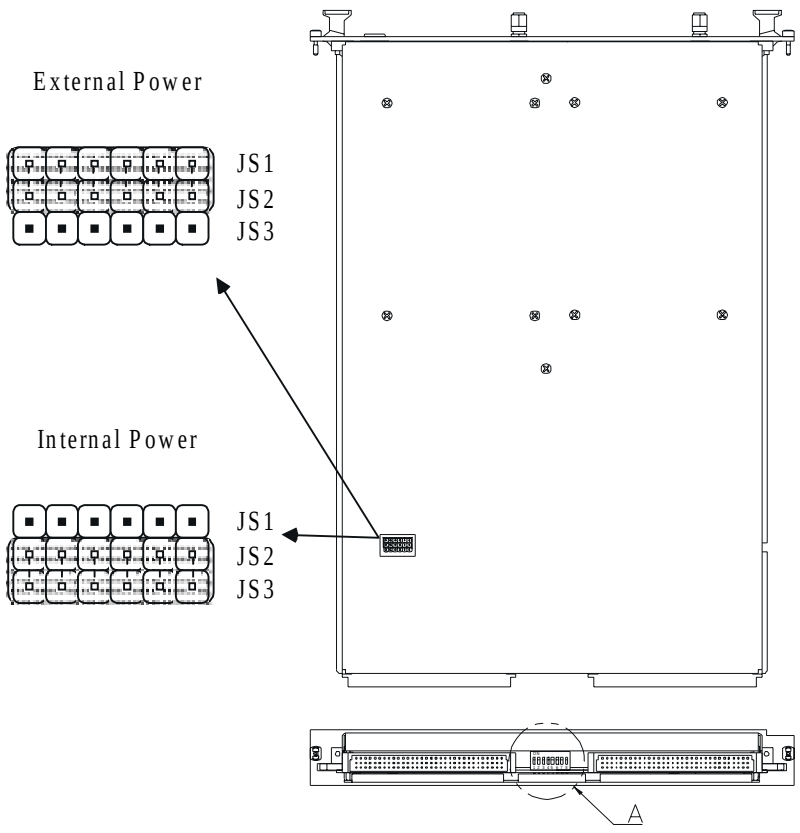

Figure 1-28. Jumper Connections For Using External Power Supply With SM25.

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Typically, the default jumper configuration (shorting JS2 & JS3) is for a single channel SM25 using internal power. If users install several SM25 modules in a mainframe at the same time, use Tables 1-5 and 1-6 to calculate the total power requirement of the modules. Then check the power capacity of the mainframe to determine if any SM25 modules need external power.

The jumper configuration for a dual channel SM25 will depend on the user's requirement. If the total output current of 2 channels is not over 1A, you can use the internal power supply alone. Otherwise, the SM25 jumpers need to be set to use external power (short JS1 & JS2).

1.22 Throughput Enhancement

There are three access modes for SM25 to get data. Proper selection of the access mode is necessary to attain optimized throughput.

1.22.1 Single point measurement (Trough FIFO)

In this mode the measured data from the DSP will be stored in the FIFO inside the module. The host system (e.g. PC) can monitor the status of the FIFO, and then fetch the data in the FIFO via the VXI bus until the FIFO is empty and the operations of the DSP stops. The depth of the FIFO is 512 words (16 bits/word). Each reading occupies 4 words in the FIFO, for a total of 128 readings. If the compare flag is enabled, the pass/fail bit will be set accordingly at the same time the V/I data is read out.

If the FIFO is filled up to 256 words, the DSP will keep the source at the latest level and the measurement will be paused until the data in FIFO is fetched. When the data number in the FIFO is less than 256, the DSP will continue to do the next SDM cycle. The data format is IEEE 754/32 Bits STD. In the FIFO, one reading includes 2 words for the voltage value and 2 words for the current value. If half of the FIFO is filled up, that means there are 64 (256 divided by 4) readings in the FIFO. Programming flow is shown below, see Figure 1-29.

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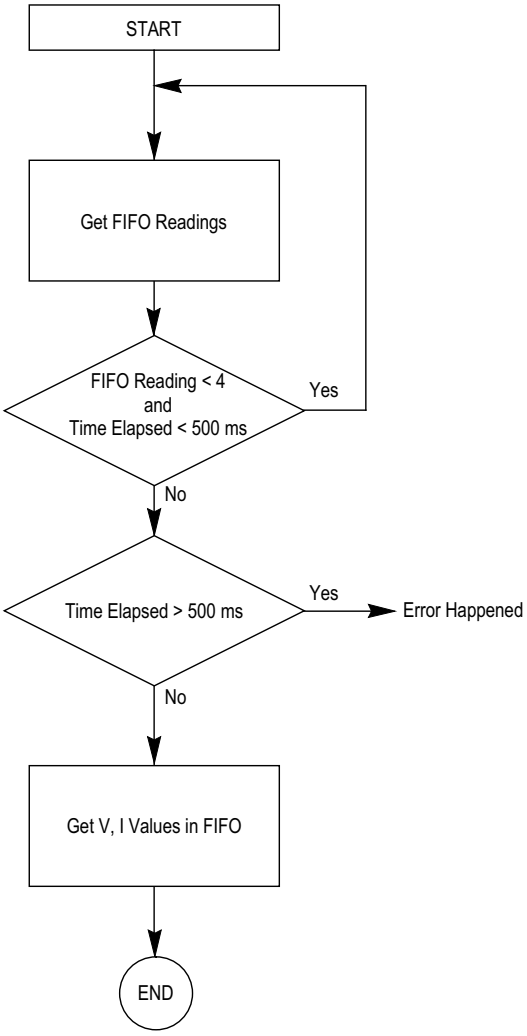

Figure 1-29. Programming Flow for Single Point Access through FIFO.

For example if you want to read 2000 measurements, the test program is:

```
/* Disable block move operation */
errStatus = itsm25_setWorkModeFunction (sm25, channel, 0, 0, 0, 1);
/* Set the number of readings to 2000 */
errStatus = itsm25_setMeasureReading (sm25, channel, 2000);
                        .
                        .
                        .
            SM25 parameter setup
                        .
                        .
/* Begin test */
startTime = Timer();
errStatus = itsm25_operationStartImm (sm25, channel);
for (i = 1; i <= 2000; i++)
{
      errStatus = itsm25_readFIFOData (sm25, channel, &volt, &amp);
```


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```
                measDataV[i] = volt;
                measDataI[i] = amp;
        }
/* Stop test */
stopTime = Timer();
```

We can record the total time elapsed and divide by 2000 to get the average time for one reading.

1.22.2 Single Point Measurement (by block move)

The measured data from the DSP will first be stored inside the DSP buffer until the measurement operation is completed. There are 8190 points in the DSP buffer. The DSP will stop the operation when the buffer is full. The DSP will then begin to transfer all the data to the FIFO inside the SM25. Because the size of the FIFO is limited to 512 words, the DSP will move the data in the DSP buffer to the FIFO with 256 words maximum at a time.

The host system (e.g. PC) can monitor the number of readings in the FIFO. If the number is more than half of FIFO depth (256 words), the PC can read 256 words using the VXI block move operation. If the number is less than half of the FIFO depth (256 words), the PC can read all the data inside FIFO using the VXI block move operation.

Like the first access mode mentioned above, each reading occupies 4 words in the FIFO. If the compare flag is enabled, the pass/fail bit will be set accordingly at the same time the V/I data is read out. Programming flow is shown below, see Figure 1-30.

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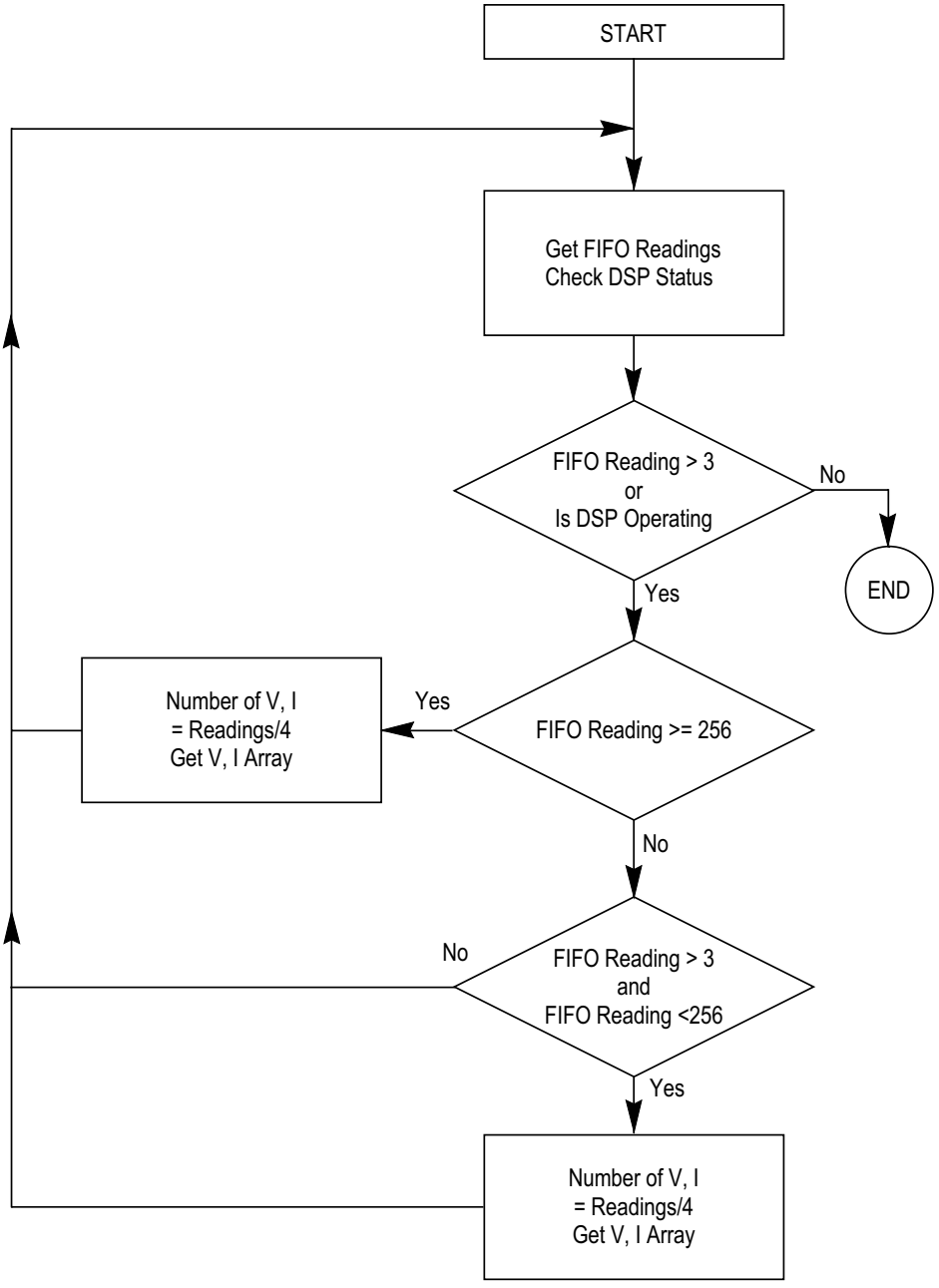

Figure 1-30. Programming Flow for Data Access Using Block Move.

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For example, if we want to access 2000 points of data using block move, the test program is:

```
/* Enable block move operation */
errStatus = itsm25_setWorkModeFunction (sm25, channel, 0, 1, 0, 1);
/* Set the number of measurement readings to 2000 */
errStatus = itsm25_setMeasureReading (sm25, channel, 2000);
                .
                .
                .
      SM25 parameters setup
                .
                .
/* Begin to test */
startTime = Timer();
count = 0;
/* Get number of readings in FIFO */
errStatus = itsm25_getFifoStatus(sm25, channel, &fifoFull, &fifoHalf,
        &fifoEmpty, &cmpPass, &fifoReading);
/*Check if DSP is operating */
errStatus = itsm25_getStatusReg (sm25, &a24Active, &modid, &ch1Opr,
        &ch1Cmp, &ch1NoErr, &ch1QRRdy, &ch1CPRdy, &ch2Opr,
        &ch2Cmp, &ch2NoErr, &ch2QRRdy, &ch2CPRdy, &ready, &passed,
        &extPwr, &ch2Inst);

while( (fifoReading > 0) | (ch1Opr == 1) )
{
        if (fifoReading >= 256)
        {
                number = 64;    /* Two words for voltage, two words for
                                        current */
                errStatus = itsm25_readFIFOBlock (sm25, channel, number,
                        voltage, current);
                p1 = voltage;
                p2 = current;
                for (i = 1; i <= number; i++)
                {
                count++;
                        measDataV[count] = *p1++;
                        measDataI[count] = *p2++;
        }
        }
        else
        {
                if ( (fifoReading > 3) && (fifoReading < 256)
                        && (opr == 0) )
                {
                        number = fifoReading/4;
```


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```
                                        errStatus = itsm25_readFIFOBlock (sm25,
                                                channel, number, voltage, current);
                                        p1 = voltage;
                                        p2 = current;
                                for (i = 1; i <= number; i++)
                                                {
                                                count++;
                                                measDataV[count] = *p1++;
                                                measDataI[count] = *p2++;
                                }
                        }
                }
        }
/* Stop to test */
stopTime = Timer();
```

We can divide the total time elapsed by 2000 to get the average time for one reading.

1.22.3 Current Value Table

If the SM25 is set to DC mode, the DSP will measure the data only when it is queried. The PC can access the measured data directly from the register. The DSP will not send any data to the output FIFO. The advantage of this method is that it is easy to the get the most current measurement, but the throughput is slower than through the FIFO due to the handshaking between DSP and PC. Programming flow is shown below, see Figure 1-31.

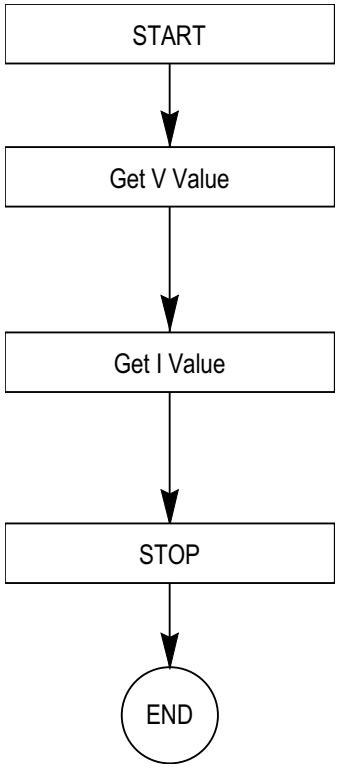

Figure 1-31. Programming Flow for Querying From Current Value Table

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For example:

```
                    .
                    .
          SM25 parameters setup
                    .
                    .
/* Start operation */
errStatus = itsm25_operationStartImm (sm25, channel);

    /* Get latest data */
errStatus = itsm25_readVoltage (sm25, channel, voltage);
errStatus = itsm25_readCurrent (sm25, channel, current);

/* Stop operation */
errStatus = itsm25_operationStop (sm25, channel);
```

1.22.4 Suggestions :

If the user needs to acquire single point data very fast, the first method is suggested. If the user needs to get a large number of measurements, the block move method is the best choice. If the user wants to get the current data, the method to get data from current value table can satisfy the requirement.

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Chapter 2
SM25 Soft Front Panel Operation

2.1 Introduction

This chapter contains operating information for the SM25 SMM (Source-Measure Module) using the VXI Plug&Play Soft Front Panel. The advantages of using the soft panel in preference to using VXI Plug&Play driver are covered in chapter 3 of this manual.

The Soft Front Panel provides interactive control for the SM25 module. Graphical displays present test results and instrument status much like that of a traditional front panel, allowing the user to control instrument functions in a familiar way.

2.2 Display Function

The display of the SM25 Soft Front Panel is shown in Fig 2-1. At the top of the figure is the status window, which identifies the VXI slot number and VXI address of the SM25, and the **"Active"** indicator (red is "off", green is "on").

Figure 2-1. Status Window of Display Panel.

You can control channel 1 or 2 by selecting Channel 1 or Channel 2, as shown in Fig 2-2.

Figure 2-2. Channel Select Bar of Display Panel.

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The temperature of the current channel, in degrees centigrade, is displayed in the Temperature window, see Fig 2-3. The SM25 is designed to operate between 0° C to 50° C.

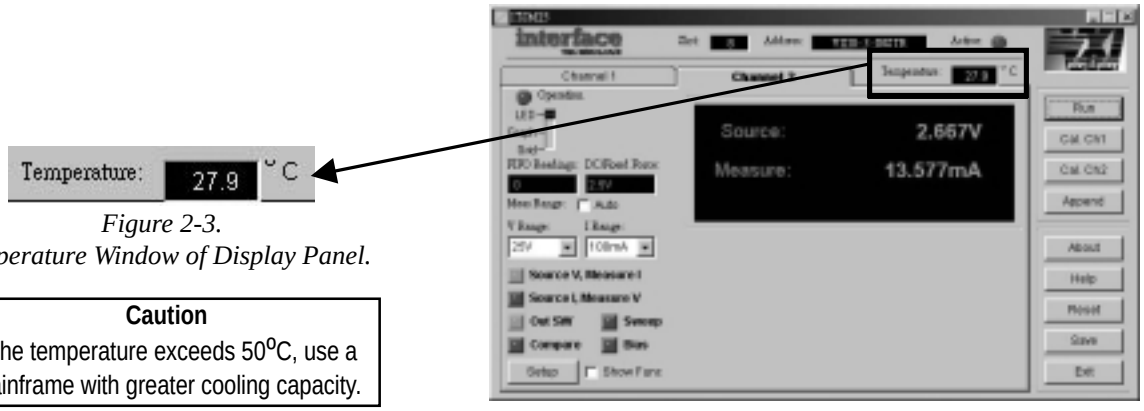

Figure 2-3.
Temperature Window of Display Panel.

Caution
If the temperature exceeds 50°C, use a mainframe with greater cooling capacity.

Click the "**Setup**" command button to change the setup parameters of the channel, see Fig 2-4. For more detailed description of the setup parameters, refer to Section 2.3.

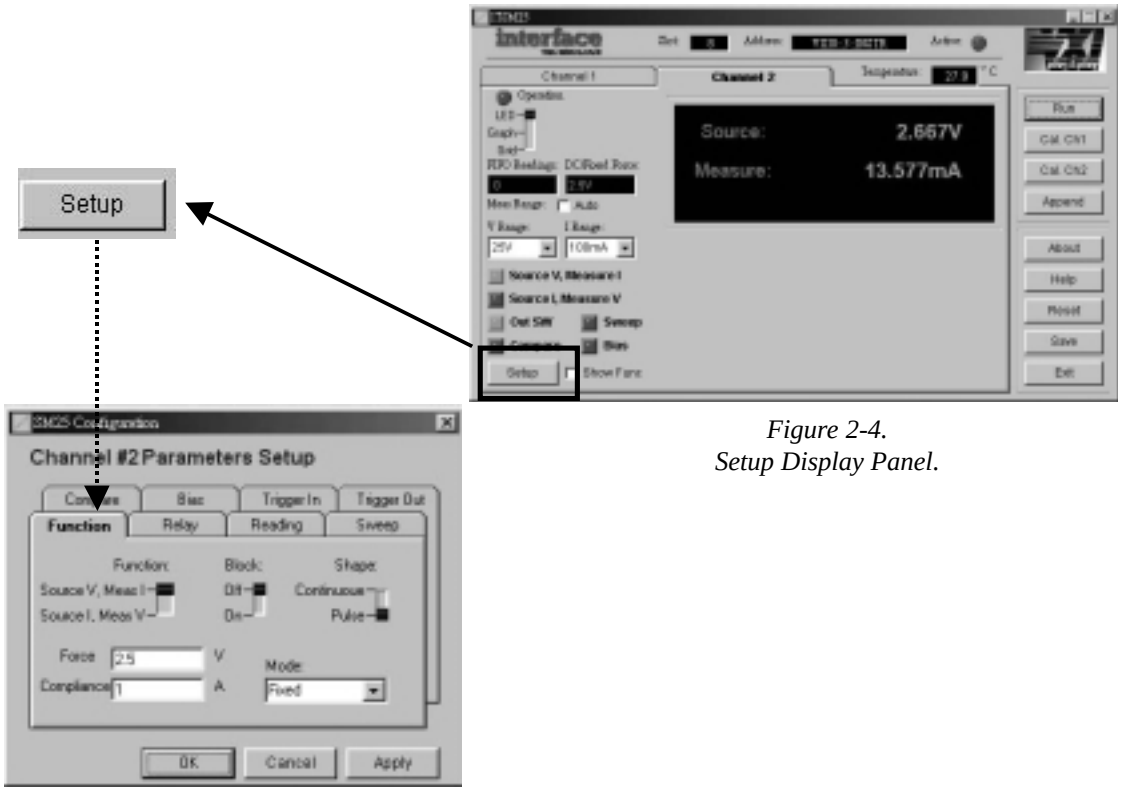

Figure 2-4.
Setup Display Panel.

Once the parameters are selected, click the "**OK**" button to save the parameters. If you don't wish to save any of the parameter changes you've just made, click the "**Cancel**" button to cancel the changes. If you want to change the parameters immediately and do not wish to leave the setup panel, you can click the "**Apply**" button to set the parameters of the module. The details of the "parameters setup" are shown in Section 2.3 of this chapter.

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You can select the appropriate V range and I range. Also you can select Auto Measure Range for better measurement. In DC mode, readings are shown in LED format only as shown in Fig 2-5.

Note
"DC Mode" can only be selected when waveform shape is "Continuous".

Figure 2-5. Range Selection of Display Panel.

After you complete changing the parameters, you will be able to see the functions you selected as they will be highlighted in brighter colors, as shown in Fig 2-6. Also, you can double-click on the LED to pop up the configuration window to change the related parameters quickly.

Figure 2-6. Function Setup of Display Panel.

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The measured voltage and current values are shown in the area of Fig 2-7.

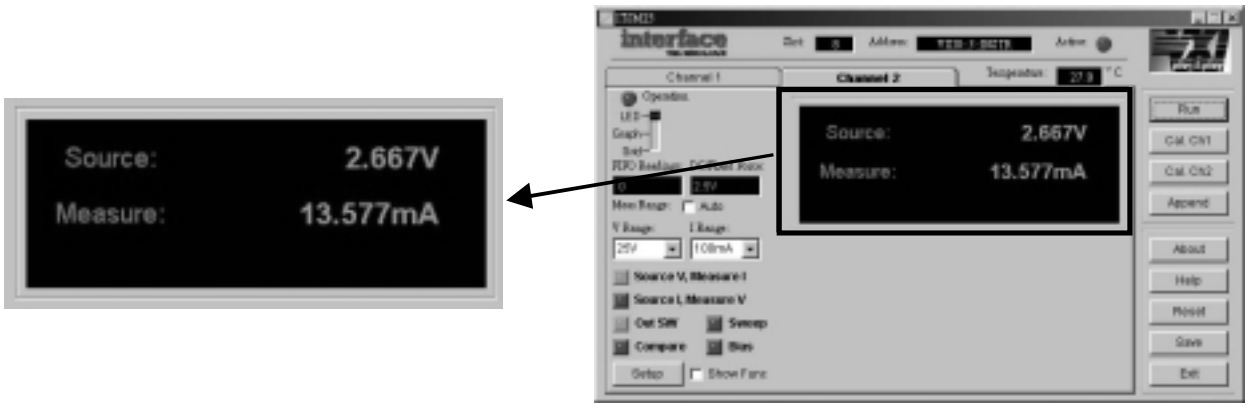

Figure 2-7. Measurement Display Panel.

The measured values are shown in **LED**, **Graph** or **Grid** format. You can select the format you want, as shown in Fig 2-8. The "**Operation**" LED will be in lit when the channel is operating.

Figure 2-8. Display Format of The Panel.

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The **LED** display panel is shown in Fig 2-9. In **LED** mode, the compare result and the sweep values are displayed, if these functions are enabled. The top line of the **LED** display panel displays "Source" on the left, and value of the source (volts or amperes) on the right side of the display. The middle line of the LED panel displays "Measure" on the left, and the measured result (volts or amperes) on the right. The bottom line of the LED display panel displays "Compare" on the left and the compare result (pass or fail) on the right.

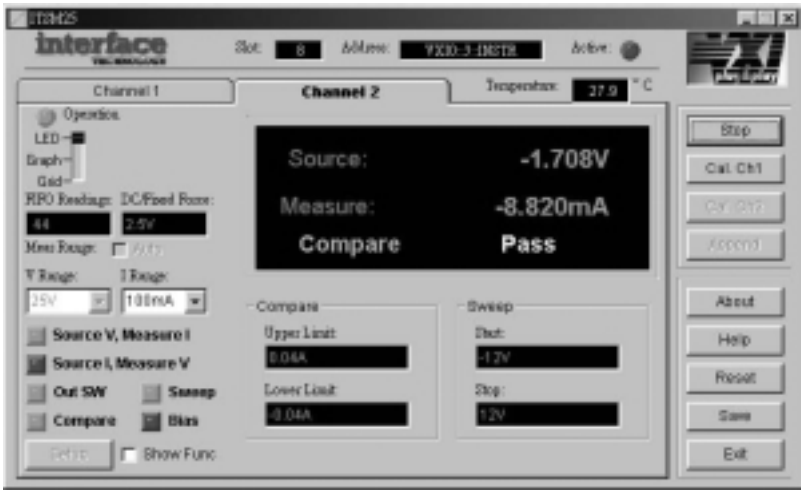

Figure 2-9. LED Display format of the Panel.

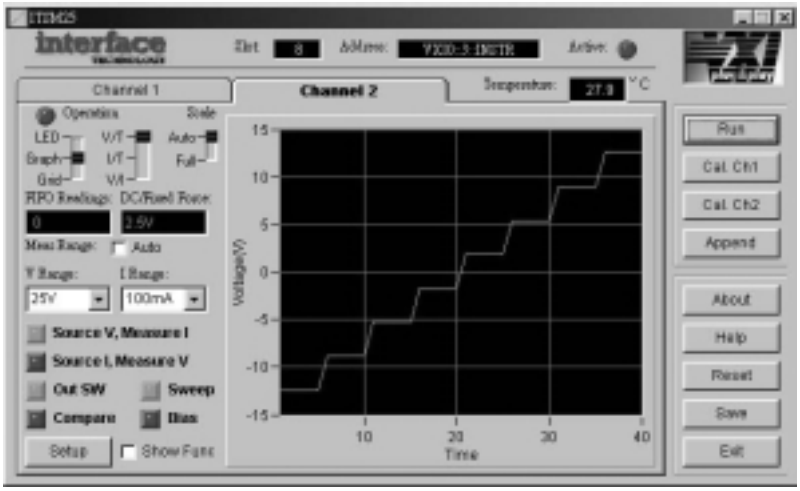

Figure 2-10. Graph Display format.

The **Graph** display format is shown in Fig 2-10. In this mode, the measured results can be graphically displayed as: voltage vs. time or current vs. time, or voltage vs. current, depending on what you select.

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The **Grid** display format is shown in Fig 2-11. In this mode, the measured values and results are displayed in a grid at the same time and can be saved as either ASCII files or Microsoft Excel files.

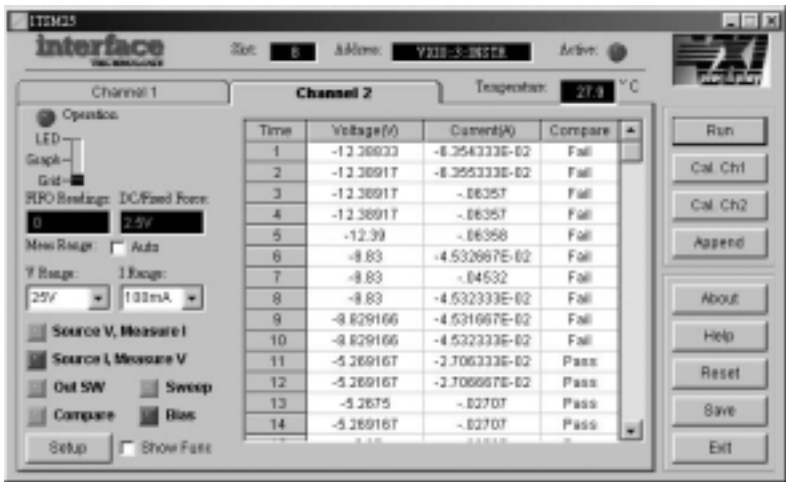

Figure 2-11. Grid Display Format.

The FIFO readings of measurement are shown in Fig 2-12.You can monitor the remaining readings of the FIFO memory for the channel from the window at any time. The corresponding force value that you set on DC or Fixed is displayed next to the FIFO readings.

Figure 2-12. FIFO Reading of Display Panel.

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In the Graph mode, you can display voltage vs. time or current vs. time, or voltage vs. current graph. The Scale select switch provides a choice of either Auto or Full Scale resolution for a better view, see Fig 2-13.

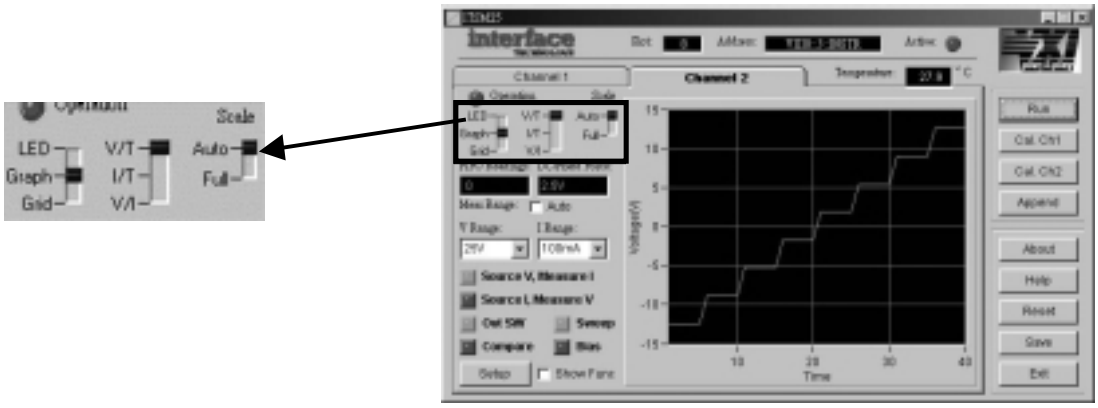

Figure 2-13. Configuration setup of Channel function Panel.

In full scale mode, the full voltage or current range that you specified is displayed. In this mode, the screen is scaled to provide the full voltage range (-25 to +25 V for Range "25V") , see Fig 2-14.

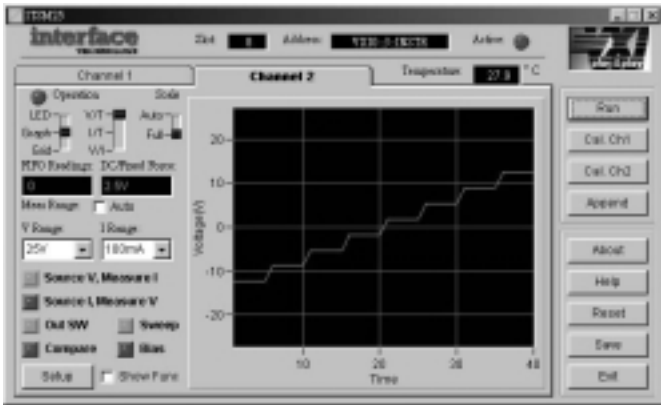

Figure 2-14. Full Scale Graph Display of Panel.

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You can change the V/I range to select the appropriate V and I range then do the measurement as shown in Fig 2-15. The selected V/I ranges are both entered in the source and measure functions. Also you can select "**Auto"** Measure Range, which allows the SM25 to select the best range for your measurement. When "**Auto**" range is selected, the SM25 will automatically downrange to the lowest possible (most sensitive and lowest possible compliance) range to make measurements.

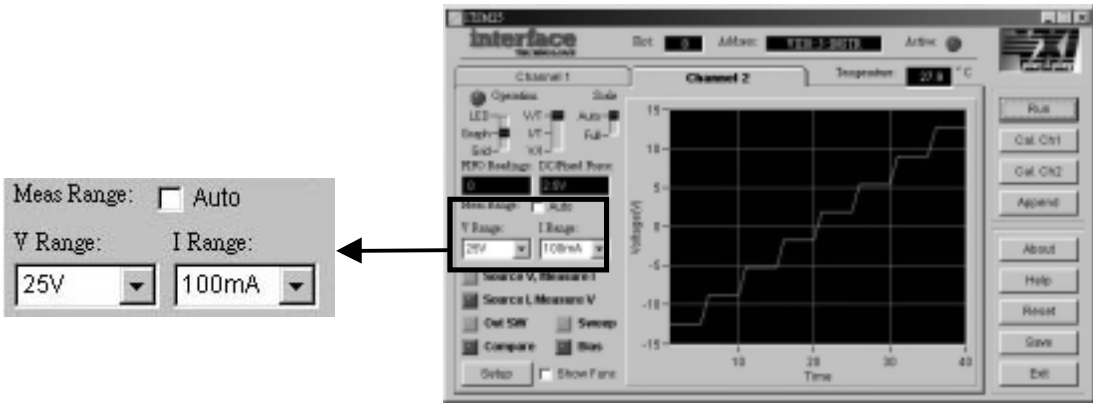

Figure 2-15. Range Selector of Display Panel.

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You can select either ***Source Voltage / Measure Current*** or S***ource Current / Measure Voltage*** functions. The available voltage source and current source ranges are listed in Tables 2-1 and 2-2. The measurement ranges are listed in Table 2-3 and Table 2-4.

Table 2-1 Voltage Source Range.

Range	Resolution	Accuracy (18-28° C)	Noise (Vpp, 0.1-10 Hz)
500 mV	20 µV	0.1% ± 600 µV	20 µV
5.00 V	200 µV	0.1% ± 900 µV	200 µV
25.00 V	1 mV	0.1% ± 2.5 mV	1 mV

Table 2-2 Current Source Range.

Range	Resolution	Accuracy (18-28° C)	Noise (Vpp, 0.1-10 Hz)
1.00 µA	50.0 pA	0.1% ± 600 pA	10 pA
10 µA	500.0 pA	0.1% ± 2.5 nA	100 pA
100 µA	5.0 nA	0.1% ± 25 nA	1 nA
1.0 mA	50.0 nA	0.1% ± 250 nA	10 nA
10 mA	500.0 nA	0.1% ± 2.5 µA	200 nA
100 mA	5.0 µA	0.1% ± 25 µA	5 µA
1,000 mA	50.0 µA	0.1% ± 900 µA	50 µA

Table 2-3 Voltage Measure Range.

Range	Resolution	Accuracy (18-28° C)
500 mV	20 µV	0.05% ± 600 µV
5.00 V	200 µV	0.05% ± 900 µV
25.00 V	1 mV	0.08% ± 2.5 mV

Table 2-4 Current Measure Range.

Range	Resolution	Accuracy (18-28° C)
1 µA	50 pA	0.05% ± 600 pA
10 µA	500 pA	0.05% ± 2.5 nA
100 µA	5 nA	0.05% ± 25 nA
1 mA	50 nA	0.05% ± 250 nA
10 mA	500 nA	0.05% ± 2.5 µA
100 mA	5 µA	0.1% ± 25 µA
1000 mA	50 µA	0.25% ± 900 µA

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2.3 Configuration

SM25 Parameters are divided into 8 groups and described as follows.

2.3.1 Function

The SM25 Function setup panel is shown in Fig 2-16.

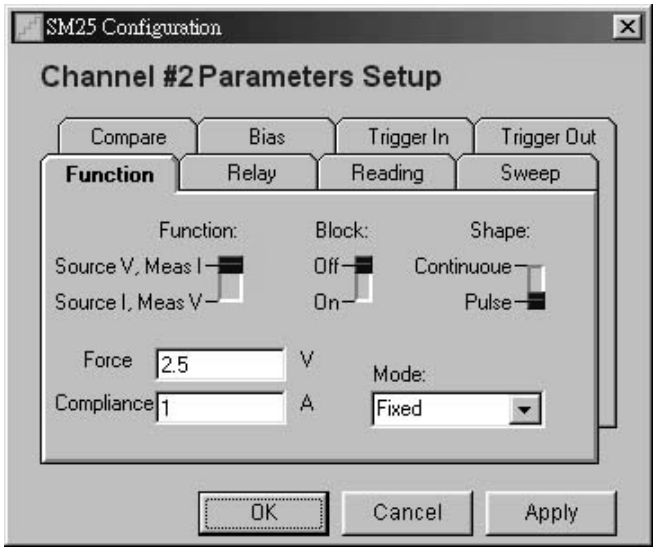

Figure 2-16. Function Setup Panel.

The "**Force**" level limit is referenced in Table 2-1 and Table 2-2. The "**Compliance**" value is set in order to protect external circuitry (i.e., DUT) from damage. When sourcing voltage, a current compliance limit is set. The SM25 will never source a current that will exceed the programmed current compliance limit. Conversely, when sourcing current, a voltage compliance limit is set. The SM25 will never source a voltage that will exceed the programmed compliance voltage limit.

The SM25 module has four operating modes. They are "**DC**", "**Fixed**", "**Sweep**"and "**Append**". In "**DC**" mode, a constant dc voltage or current is supplied to the output. This operation consists of a continuous series of Source-Delay-Measure (SDM) cycles and the measured reading are internally updated, making them available for display. When in the "**DC"** mode, the readings are shown in LED format only and the Source shape should be set to "**continuous**".

In "**Fixed**" operation, the module sources a fixed dc level. As in the case of **DC** operation, this operation consists of a continuous series of Source-Delay-Measure (SDM) cycles and the measured readings will be internally updated, making them available for display. The Fixed mode has two waveform shapes. One is "**continuous**", the other one is "**Pulse**". The waveform shapes are shown in Fig 2-17. Also, the "**Sweep**" and "**Append**" operation have both waveform shapes.

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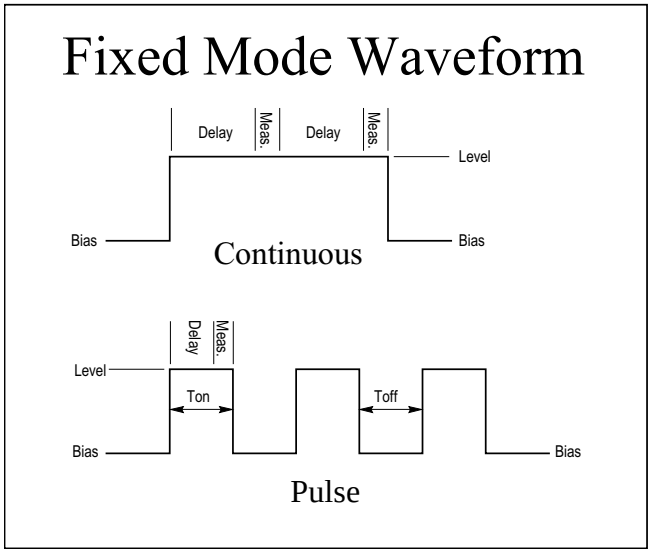

Figure 2-17. Fixed Operation Waveform.

2.3.2 Relay

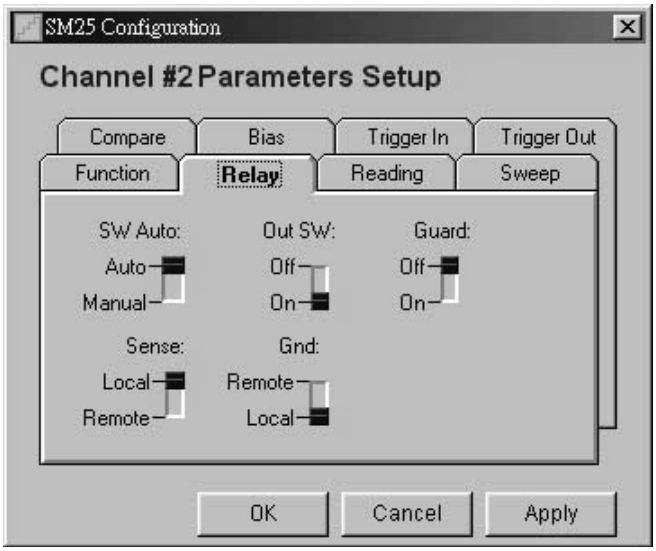

Figure 2-18. Relay Setup Panel.

The SM25 is a register-based VXI module that contains four relays that can be directly controlled by register programming. They are:

(1) Output SW relay: this switch isolates the internal buffer from the DUT. Whenever you want to prevent the output of the SM25 from going to the DUT, you can turn this switch off. In general, if the SW/Auto switch is set to "AUTO", the switch will be closed when the SM25 starts to source the desired value and will be open after the SM25 finishes operation automatically. If the SW/Auto switch is set to "Manual" , user can turn the switch on or off anytime manually.

(2) GUARD relay: You can set the GUARD signal output (off/on) using this switch.

(3) SENSE relay: This switch can perform "Kelvin" connection. Such four-wire connection allows you to have a precision measurement in a higher current environment.

(4) GND Remote/Local: this switch offers a selection of Remote Ground or Local Ground.

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2.3.3 Reading

The Reading setup screen is shown in Fig 2-19.

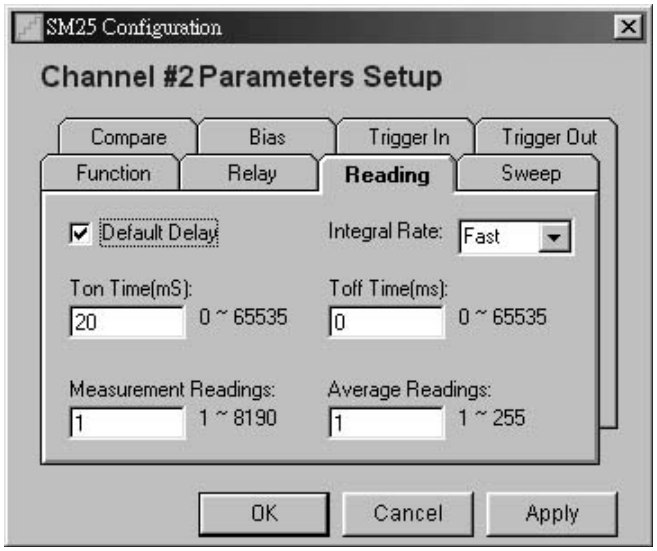

Figure 2-19. Reading Setup Panel.

The selectable "**Integral rate**" on the Reading Setup Panel offers a tradeoff between speed, resolution and noise rejection. The fast integral period provides the fastest measurements and should be used when speed is the most important consideration. The low integration rate provides the slowest but most stable measurements. Table 2-5 summarizes the integration rate selections.

Table 2-5. Integration Rates.

Selection	**Integrated Points**	**Sampling Points** (every 16 µs)
Slow	32	96
Medium	16	48
Fast	1	3

An illustration of "**Ton Time**" and "**Toff Time**" is shown in Fig 2-19. Each variable of measurement can be accessed through the soft-front panel and setup in the "**Measurement Readings**" column. The parameter can be up to 8190 readings correlated in time.

The "**Average Readings**" can be set on the Reading Setup Panel. When the average is enabled, the SM25 acquires and averages up to 255 successive A/D conversions for each measurement. Since noise is mostly random distribution in nature, it can be largely canceled out with this method.

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2.3.4 Sweep

The SM25 forces variable source levels. As in the case of "**DC"** operation, this operation consists of a continuous series of Source-Delay-Measure (SDM) cycles and the measured readings will be internally updated, making them available for display. The source condition parameters "**Sweep Start**", "**Sweep Stop**", "**Log Step**" and "**Linear Step**" are shown as Fig 2-20. When you use the SM25 in the log sweep mode, the start value and stop value should not cross zero.

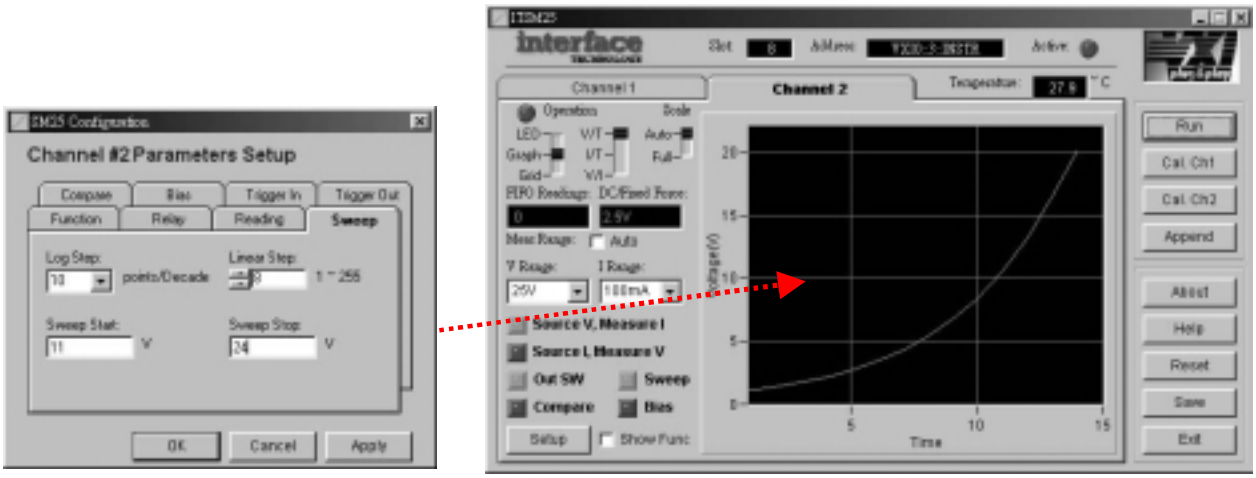

Figure 2-20. Sweep Setup Panel.

As shown in Fig 2-21, this sweep steps from a start source value to a stop source value. When the sweep is triggered to start, the output will go from the bias level to the start source level. The output will change in equal steps until the stop source level is reached. The time duration at each step of the sweep is largely determined by the programmed delay (Ton). The time duration at the bias level is determined by the off time (Toff). A measurement occurs after the delay on each step. After taking the last measurement at the stop source level, the output returns to the bias level. If off time (Toff) equals zero, then the waveform is continuous, otherwise the waveform is discontinuous (pulse).

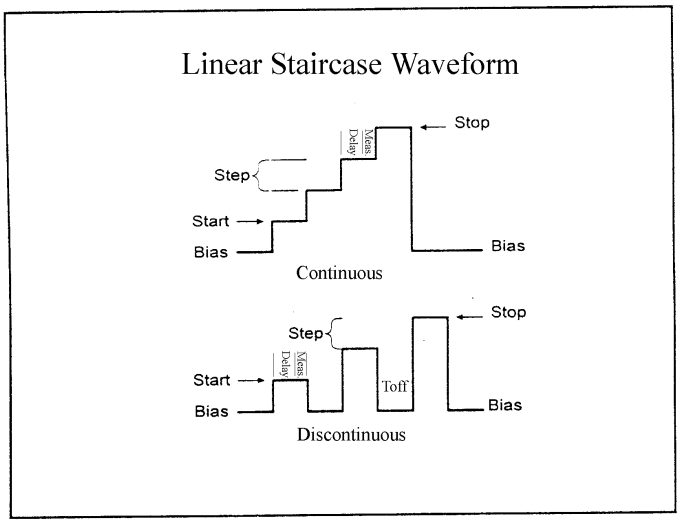

Figure 2-21. Linear Staircase Waveform.

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The logarithmic sweep is similar to the preceding staircase sweep, however the steps are done on a logarithmic scale as shown in Fig 2-22. When this sweep is triggered to start, the output will go from the bias level to the start source level. The "**Log Step**" determines the step values for the staircase. The source values are no more than "**Sweep Stop**" level. The SM25 will automatically select step values that will provide symmetrical steps on log scale through each source decade to the stop source level, as shown in the following example. The time duration at each step of the sweep is largely determined by the programmed delay (Ton). A measurement occurs after the delay on each step. After taking the last measurement at the stop source level, the output returns to the bias level. If it is in the discontinuous condition, the time duration at the bias level is determined by the off time (Toff). When Toff equals zero, the condition is continuous source. The thing to remember here is that in the linear sweep mode, the sweep can scan from a positive to a negative value or from a negative to a positive value. But when the output is swept in the logarithmic mode, the Source-Measure Module can only sweep in a positive or a negative direction, but not both. That is, sweeping across the zero point is not allowed in the logarithmic mode.

Example: Start = **a**, Stop = **b**, Points = **c**

→ start level = **a***10^(1/**c**)
2nd level = **a***10^(2/**c**)
3rd level = **a***10^(3/**c**)
.....
Last(n) level = **a***10^(n/**c**) but no more than **b**

Note: **c** is not the number of the source steps

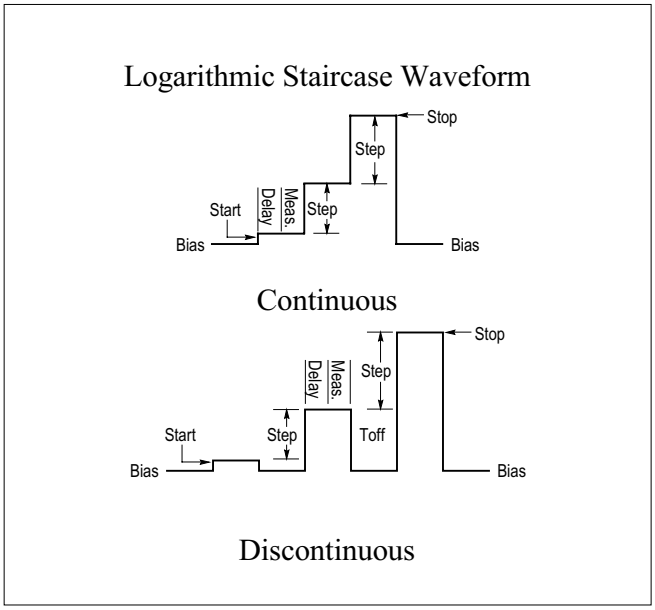

Figure 2-22. Logarithmic Staircase Waveform.

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2.3.5 Compare

If you enable the compare function, you can enter the "**Upper Limit**" and "**Lower Limit**" into the compare setup panel. Then you can see through the red lines showing on the display the values of the upper and lower limits. When the SM25 gets the measured value, the SM25 will auto compare the measured result with the limits and display Pass or Fail. The Compare Setup Panel and waveform is shown in Fig 2-23.

Figure 2-23. Compare Setup Panel.

2.3.6 Bias

The bias function of Bias Setup Panel allows you to set the bias level and the bias delay of the SM25, see Fig 2-24. The default delay is used to allow for internal settling on the low current ranges. The programmable delay "**Ton**" is available to compensate for longer settlings caused by external circuitry. The more capacitance that is seen at the output, the more settling time that is required for the source. The actual delay period needed can be calculated or determined by trial and error. For resistive loads and higher currents, the programmable delay "**Ton**" can be set to 0 ms.

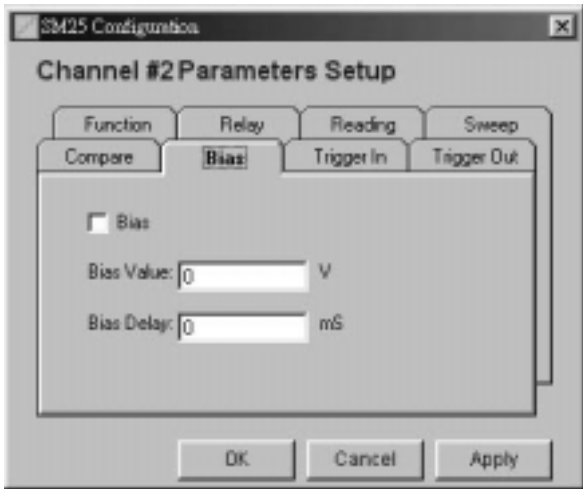

Figure 2-24. Bias Setup Panel.

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2.3.7 Trigger In

You can enable **"Trigger In"** function. If so, the module will operate when it receives the trigger from VXI bus. The SM25 module can accept the trigger line from TTLTRG0 -- TTLTRG7. Both channels can have their own independent trigger source. The trigger mode can be set as continuous or count by a defined number. Trigger command, or count by a defined number. The maximum number of **"count"** is 255. The SM25 module also has a timer to count the trigger input signal for different applications. The setup screen is shown in Fig 2-25.

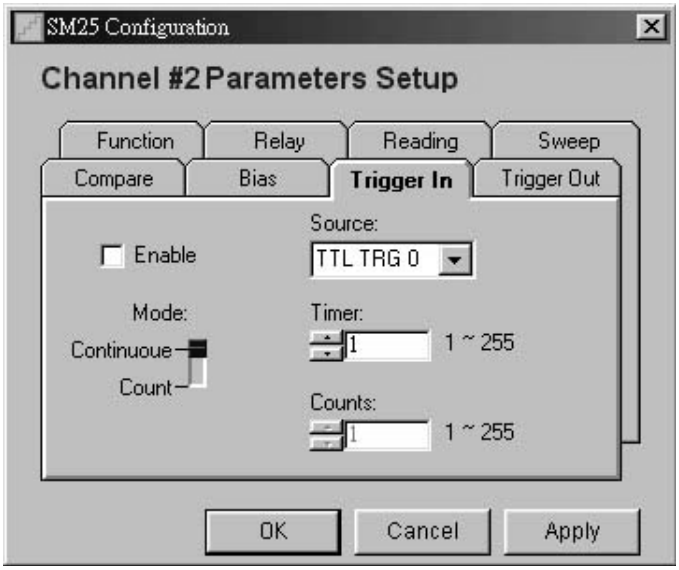

Figure 2-25. Trigger In Setup Panel.

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2.3.8 Trigger Out

The trigger out setup panel is shown as Fig 2-26. If you enable **"Trigger Out"** function, the module will send trigger out pulse from one of the six timing functions. Remember the level state is the same for both channels.

Note:

"Compare" function on the Compare Panel must be enabled to have the "Compare passed" and "Compare failed" timing options.

User can set different output conditions as follows:

(1) Start of step: Trigger output at each start of step.
(2) End of step: Similar to above but trigger output at the end of each step.
(3) Start of operation: Trigger output at operation start.
(4) End of operation: Similar to (3) but trigger output after operation completed.
(5) Compare passed: Output a pulse after each compare pass operation.
(6) Compared failed: Output a pulse after each compare fail operation.

Channel 1 & 2 of SM25 can be set to drive different trigger output lines and you can select between two polarity output levels, low pulse or high pulse. Both of the channels should have the same trigger out level.

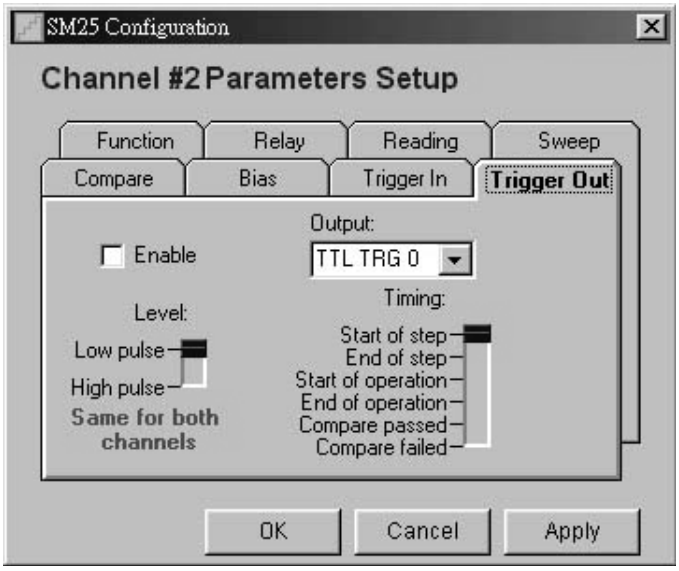

Figure 2-26. Trigger Out Setup Panel.

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2.4 Execution

Clicking on the "**Run**" command button (Fig 2-27), causes the SM25 to execute the configuration condition to source and measure. The results will be displayed as previously described.

*Figure 2-27. "**Run**" Command Button.*

2.5 Save

Click on the "**Save**" button to save SM25 measured results. You can save measured values in ASCII text file or Microsoft Excel file format, depending on the extension name of the file. The operation panel is shown in Fig 2-28. **Be sure to install Microsoft Excel before you save as Excel format.**

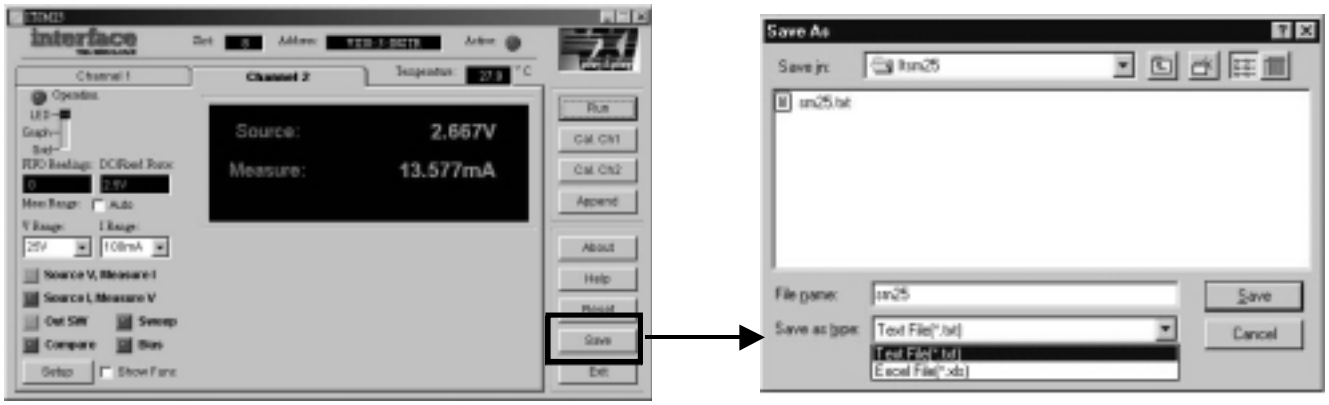

Figure 2-28. Save As Panel.

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2.6 About

Click the "**About**" button to view pertinent information about Interface Technology. The driver version is also displayed from the "About" form, see Fig 2-29.

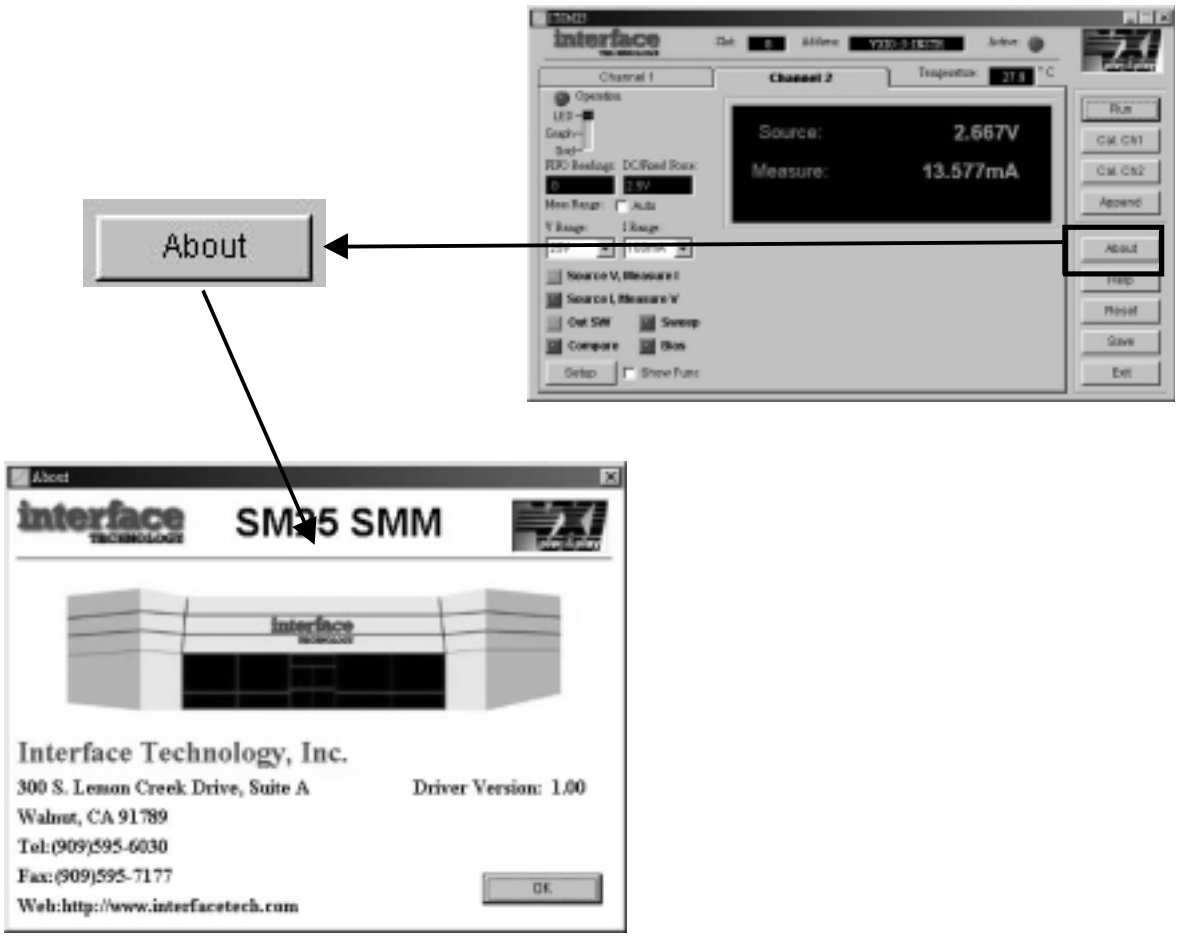

*Figure 2-29. The "**About**" Panel.*

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2.7 Append

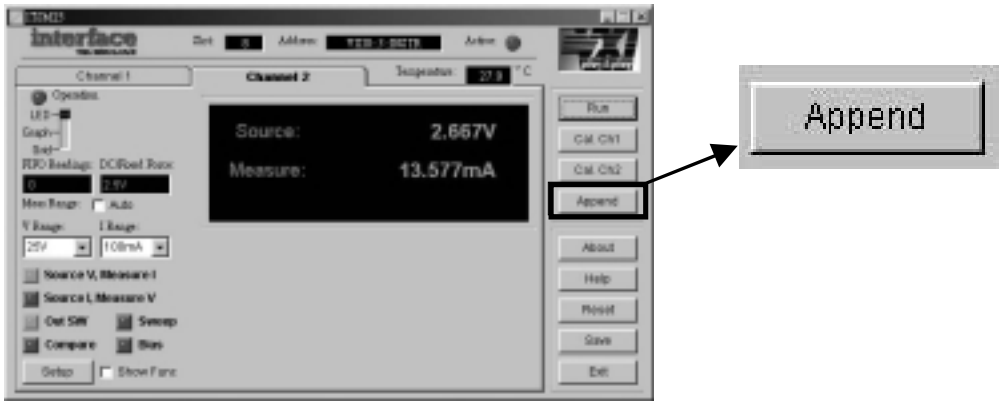

*Figure 2-30. The "**Append**" Button.*

The SM25 append feature permits up to 255 steps with any desired source values. Fig 2-30 shows the **"Append"** button. When you click the **"Append"** button, the SM25 Append Mode Setup form will show up. Then the users can key in the number of valid steps from 1 to 255, see Fig 2-31. Depending on the function mode (source V or source I), users can key in voltage or current value in the grid. On the right side you can see the range of the source. The value you want to enter should not exceed the range.

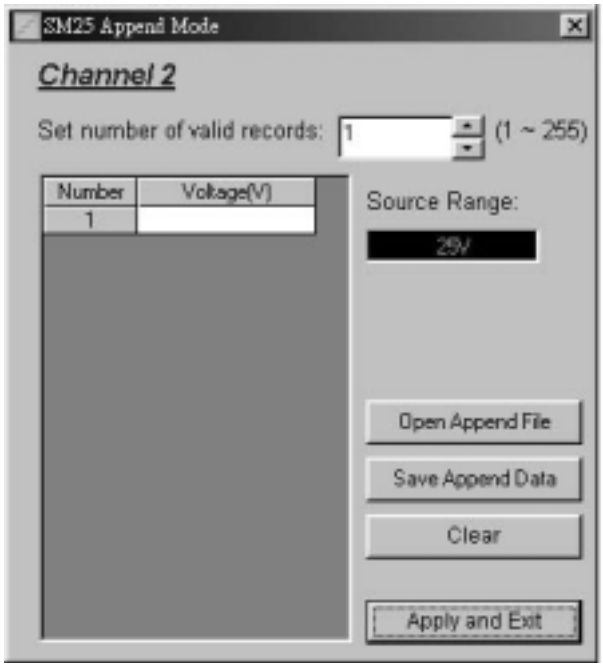

Figure 2-31. The Append Mode Form.

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You can key in or change the appended value directly by clicking the grid you want. You can also add or delete the number of valid steps. In addition, you can save the values into an ASCII file for future use. You can also load the data from the ASCII file to the grids for added convenience. The Append Setup Form is shown in Fig 2-32.

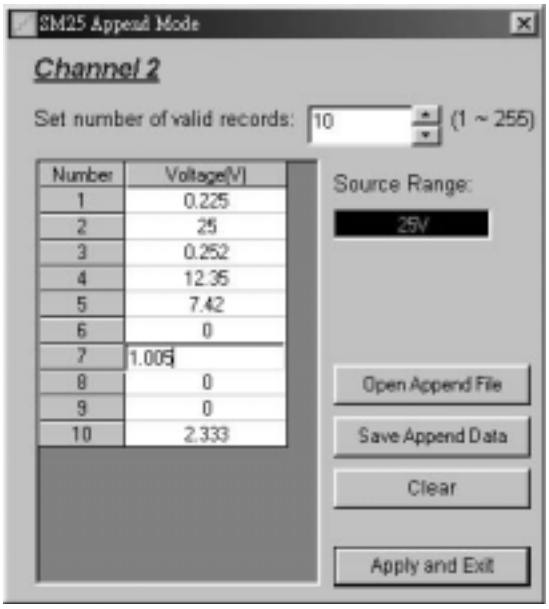

Figure 2-32. The Append Setup Form.

Once the data is completed, click **"Apply and Exit"** and then click **"Run"**. A waveform example that you can setup in the append mode is shown in Fig 2-33.

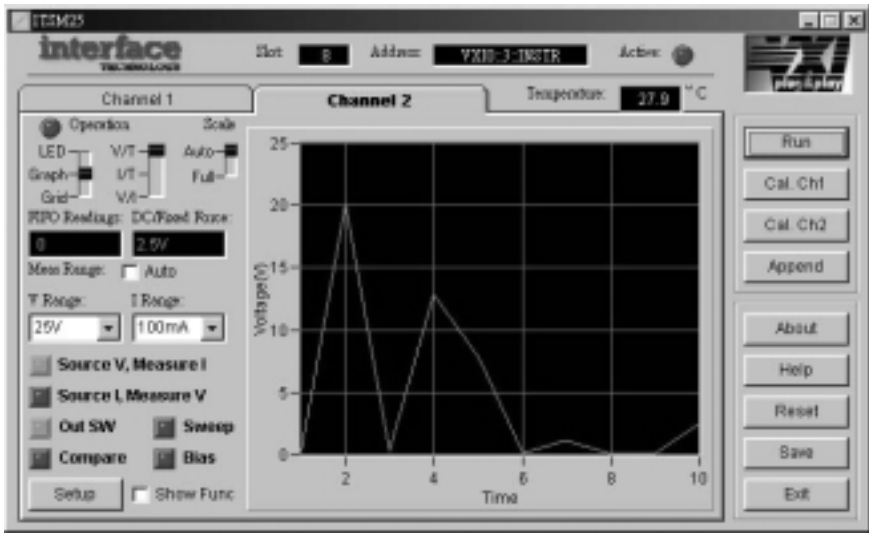

Figure 2-33. The Append Waveform Panel.

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2.8 Calibration

Calibration should be performed every 12 months. Calibration should be performed under laboratory conditions having an ambient temperature of 23 ± 1.5 degrees C and a relative humidity of less than 70%. Before performing the calibration procedures, turn on the SM25 and allow it to warm up for at least one hour.

Click the "**Cal. Ch1**" or "**Cal. Ch2**" button to calibrate SM25 channel 1 or channel 2. The "**Cal. Ch1**" and "**Cal. Ch2**" button are shown in Fig 2-34. Refer to Chapter 5 for step-by-step calibration procedures. If any of the calibration steps cannot be performed without error, please contact Interface Technology.

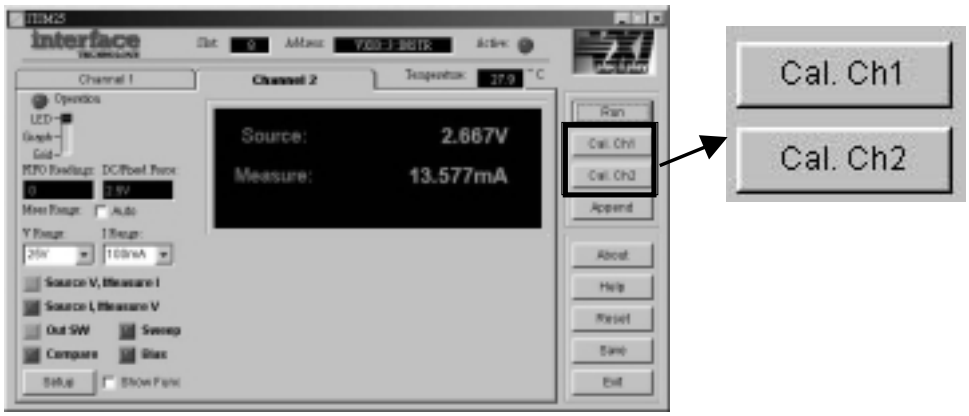

Figure 2-34. Calibration Selecting Buttons.

2.9 Reset

Click the "**Reset**" button of display panel to reset SM25 module. The "**Reset**" button is shown in Fig 2-35.

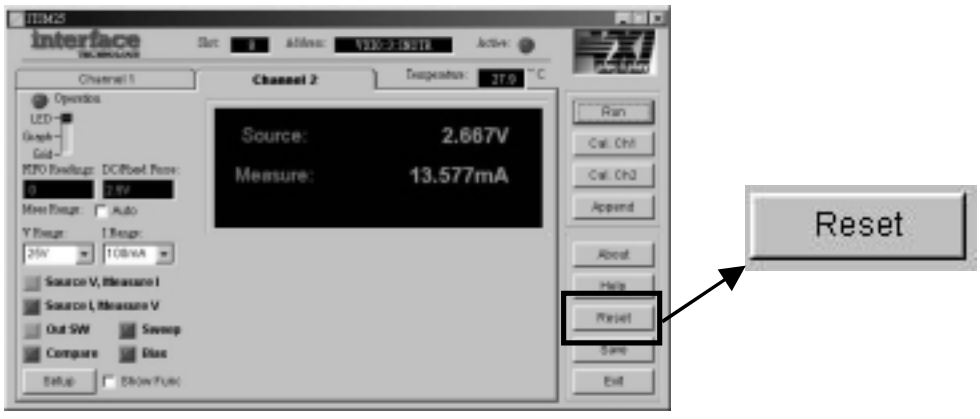

*Figure 2-35. "**Reset**" Button .*

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2.10 Help

Click the "**Help**" button of display panel to get SM25 help information. The "**Help**" button is shown in Fig 2-36.

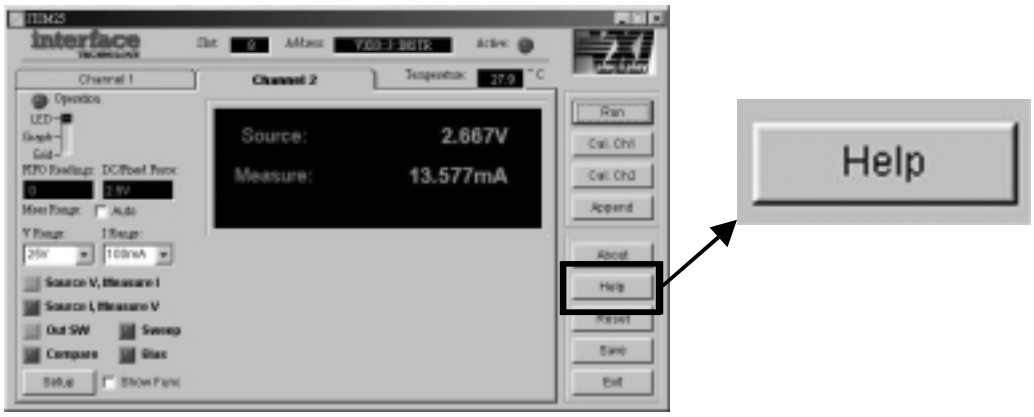

Figure 2-36. "**Help**" Button.

2.11 Real Time VXI P&P Functions Display

You can enable "**Show Func**" to show SM25 VXI P&P functions in real time to observe which function commands are currently in use to control the SM25. The "**Show Func**" check box is shown in Fig 2-37.

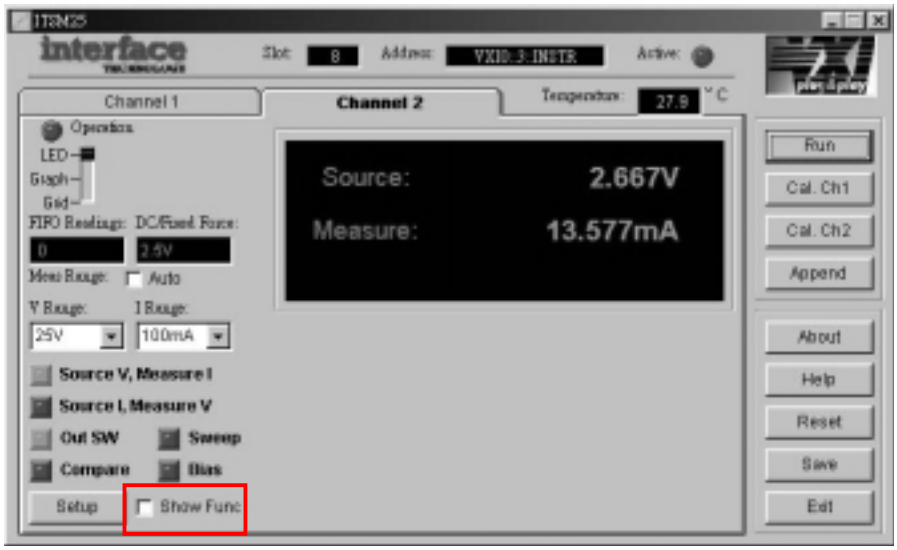

*Figure 2-37. Location of The "**Show Func**" Check Box.*

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As you enable this function, you can get the functions corresponding to the actions. But it will take more time to get a measurement reading. Users can copy the function commands and then paste in their test program to get the environment they want. The PnP function commands are shown in Fig 2-38.

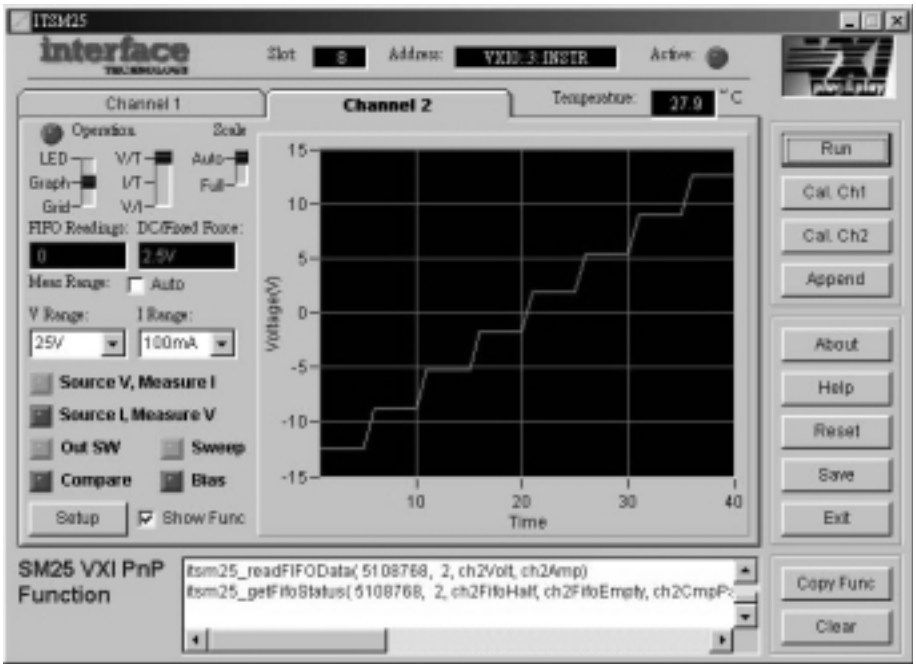

Figure 2-38. The PnP Function Commands Display Panel.

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Chapter 3
Programming With VXI Plug&Play Drivers

3.1 Introduction.

This instrument driver provides programming support for the Interface Technology SM25 Production Source-Measurement Module. It contains functions for opening, configuring, taking measurements with, and shutting down the instrument.

3.2 Assumptions

To successfully use this module, the following conditions must be met:

For VXI instrument drivers:

- The instrument is installed in the VXI mainframe and you are using one of the following controller options:

  Embedded controller

  MXI
  MXI2
  Firewire

- The logical address supplied to the initialize function must match the logical address of the instrument.

3.3 Error and Status Information

Each function in this instrument driver returns a status code that either indicates success or describes an error or warning condition. Your program should examine the status code from each call to an instrument driver function to determine if an error occurred.

The general meaning of the status code is as follows:

Value	Meaning
0	Success
Positive Values	Warnings
Negative Values	Errors

The description of each instrument driver function lists possible error codes and their meanings.

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3.4 How To Use This Document

Use this document as a programming reference manual. It describes each function in the SM25 Source Measurement Module instrument. The functions appear in alphabetical order, with a description of the function and its C syntax, a description of each parameter, and a list of possible error codes.

3.5 Function Tree Layout

SM25 Source Measurement Module	Function Name:
Initialize	itsm25_init
Configuration Functions	
Set Work Mode and Function	itsm25_setWorkModeFunction
Set Source Range and Relays	itsm25_setSourceRangeRelay
Set Integral Rate	itsm25_setIntegralRate
Set No. of Measurement Readings	itsm25_setMeasureReading
Set No. of Average per Readings	itsm25_setAverage
Set Ton Time	itsm25_setTonTime
Set Toff Time	itsm25_setToffTime
Set Default Delay	itsm25_setDefaultDelay
Set DC/Fixed Command Value	itsm25_setDcFixedCommand
Set Voltage Compliance Value	itsm25_setVoltageCompliance
Set Current Compliance Value	itsm25_setCurrentCompliance
Set Bias Function	itsm25_setBiasFunction
Set Bias Voltage Value	itsm25_setBiasVoltage
Set Bias Current Value	itsm25_setBiasCurrent
Set Bias Delay	itsm25_setBiasDelay
Set number of Valid Records	itsm25_setValidRecord
Set Append Value	itsm25_setAppendValue
Set Compare Function	itsm25_setCompareFunction
Set Upper Limit of Window Comp	itsm25_setUpperLimit
Set Lower Limit of Window Comp	itsm25_setLowerLimit
Set Trigger Level	itsm25_setTriggerLevel
Query Functions	
Get Work Mode and Function	itsm25_getWorkModeFunction
Get Source and Relay Settings	itsm25_getSourceRelaySetting
Get Integral Rate	itsm25_getIntegralRate
Get No. of Measurement Readings	itsm25_getMeasurementReading
Get No. of Average per Readings	itsm25_getAverageReading
Get Ton Time	itsm25_getTonTime
Get Toff Time	itsm25_getToffTime
Get Default Delay	itsm25_getDefaultDelay
Get DC/Fixed Command Value	itsm25_getDCFixedValue
Get Compliance Value	itsm25_getCompliance
Get Bias Function	itsm25_getBiasFunction
Get Bias Value	itsm25_getBias
Get Bias Delay	itsm25_getBiasDelay
Get Compare Function	itsm25_getCompareFunction
Get Upper Limit of Window Comp	itsm25_getUpperLimit
Get Lower Limit of Window Comp	itsm25_getLowerLimit

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Get Driver Circuit Temperature	itsm25_getTemperature
Get FIFO Status	itsm25_getFifoStatus
Get Status Register	itsm25_getStatusReg
Get Trigger Settings	itsm25_getTrigger
Sweep Functions	
Set Log and Linear Steps	itsm25_setSweepLogLinStep
Set Start Value in Sweep Mode	itsm25_setSweepStart
Set Stop Value in Sweep Mode	itsm25_setSweepStop
Get Sweep Steps	itsm25_getSweepSteps
Get Start Value in Sweep Mode	itsm25_getSweepStart
Get Stop Value in Sweep Mode	itsm25_getSweepStop
Action/Status Functions	
Stop Operation	itsm25_operationStop
Start Operation Immediately	itsm25_operationStartImm
Start Operation Armed by Trig	itsm25_operationStartArmedTrig
Reset Channel	itsm25_resetChannel
Data Functions	
Read Voltage Value	itsm25_readVoltage
Read Current Value	itsm25_readCurrent
Read A24 Shared Memory	itsm25_readSharedMemory
Read V and I Values in FIFO	itsm25_readFIFOData
Read V and I with FIFO Block	itsm25_readFIFOBlock
Calibration Functions	
Calibration	itsm25_calibration
Calibrate Next Procedure	itsm25_calibrationNext
Stop Calibration	itsm25_calibrationStop
Calibration Range Setting	itsm25_calibrationRange
Calibration keying number	itsm25_calibrationKeying
Save Cal Results to EEPROMs	itsm25_calibrationSave
Read Cal result	itsm25_calibrationRead
Cancel Calibration	itsm25_calibrationCancel
Common Mode Calibration	itsm25_calibrationCommonMode
Utility Functions	
AutoConnect To First Instrument	itsm25_autoConnectToFirst
AutoConnect To All Instruments	itsm25_autoConnectToAll
Write To Instrument	itsm25_writeInst
Read Instrument Data	itsm25_readInst
Reset	itsm25_reset
Self-Test	itsm25_self_test
Time Out Setup	itsm25_timeOut
Time Out Query	itsm25_timeOutQuery
Error-Query	itsm25_error_query
Error Message	itsm25_error_message
Revision Query	itsm25_revision_query
Close	itsm25_close

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3.6 Functions/Classes Description

Description

This instrument module provides programming support for the SM25. The module is divided into the following functions:

Functions/Classes:

(1) Initialize:

This function initializes the instrument and sets it to a default configuration.

(2) Configuration Functions: (Class)
This class of functions configures the instrument by setting acquisition and system configuration parameters.

(3) Query Functions: (Class)
This class of functions queries the instrument to get all system configuration parameters and FIFO status except the parameters of the Append Mode.

(4) Sweep Functions: (Class)
This class of functions set up the sweep mode of the instrument.

(5) Action/Status Functions: (Class)
This class of functions begins or terminates an acquisition. It also provides functions that allow the user to determine the current status of the instrument.

(6) Data Functions: (Class)
This class of functions transfers data from the instrument.

(7) Calibration Functions: (Class)
This class of functions controls the calibration procedures of the instrument.

(8) Utility Functions: (Class)
This class of functions provides lower level functions to communicate with the instrument, and change instrument parameters.

(9) Close:
This function takes the instrument offline.

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The following functions are in alphabetical order.

itsm25_autoConnectToAll

ViStatus itsm25_autoConnectToAll (ViSession instrArray[], ViUInt16 arrayLength, ViUInt1 *numConnected);

Purpose

Description: To establish communication with the instrument. autoConnectToAll attempts to find module(s) supported by the driver in the system. It will connect to all instances of the instrument found. If no instrument of this type is found, autoConnectToAll will fail.

Parameter List

instrArray

Variable Type ViSession[]

Description: Array of session handles.

arrayLength

Variable Type ViUInt16

Description: Size of instrument handle array.

numConnected

Variable Type ViUInt16 (passed by reference)

Description: The number of instrument handles in the array.

Return Value

Reports the status of itsm25_autoConnectToAll.

0 No error (the call was successful).

BFFC0002 Parameter 2 (array Length) out of range.
BFFF0000 Miscellaneous or system error occurred.
BFFF000E Invalid object or session handle.
BFFF000F Resource locked for the specified access.
BFFF0015 Time Out expired before operation completed.
BFFF0034 Violation of raw write protocol occurred.
BFFF0035 Violation of raw read protocol occurred.
BFFF0036 Device reported an output protocol error.
BFFF0037 Device reported an input protocol error.
BFFF0038 Bus error occurred during transfer.
BFFF0067 Operation is not supported on this session.

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itsm25_autoConnectToFirst

ViStatus itsm25_autoConnectToFirst (ViSession *instrSession);

Purpose

Description: To establish communication with the instrument. This function searches the VXI system for a module supported by the driver. It establishes communication with the first module found.

Parameter List

instrSession

Variable Type ViSession (passed by reference)

Description: Returns an Instrument Handle that is used in all subsequent function calls to differentiate between different sessions of this instrument driver.

Return Value

Reports the status of itsm25_autoConnectToFirst.

---

0 No error (the call was successful).

BFFF0000 Miscellaneous or system error occurred.
BFFF000E Invalid object or session handle.
BFFF000F Resource locked for the specified access.
BFFF0015 Time Out expired before operation completed.
BFFF0034 Violation of raw write protocol occurred.
BFFF0035 Violation of raw read protocol occurred.
BFFF0036 Device reported an output protocol error.
BFFF0037 Device reported an input protocol error.
BFFF0038 Bus error occurred during transfer.
BFFF0067 Operation is not supported on this session.

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itsm25_calibration

ViStatus itsm25_calibration (ViSession instrSession, ViUInt16 channel);

Purpose

Description Process into calibration procedures.

Parameter List

instrSession

Variable Type ViSession

Description Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

Return Value

Reports the status of itsm25_calibration

———————————————————————————————-

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.

BFFF0804 CH1 is not ready for VXI to write.

BFFF0805 CH2 is not ready for VXI to write.

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

BFFF003A Unable to start operation because setup is invalid (due to attributes being set to inconsistent state).

BFFF004E Invalid address specified.

BFFF0051 Invalid offset specified.

BFFF0054 Specified offset is not accessible from this hardware.

BFFF0067 Operation is not supported on this session.

BFFF0070 The specified offset is not properly aligned for the access width of the operation.

BFFF0076 Specified width is not supported by this hardware.

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itsm25_calibrationCancel

ViStatus itsm25_calibrationCancel (ViSession instrSession, ViUInt16 channel);

Purpose

Description: Cancel the current calibration procedures.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

Return Value

Reports the status of itsm25_calibrationCancel.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_calibrationKeying

ViStatus itsm25_calibrationKeying (ViSession instrSession, ViUInt16 channel, float number);

Purpose

Description: Keying a float number in calibration procedure.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

number

Variable Type float

Description: Key in the voltage or current value read from the external instrument.

Return Value

Reports the status of itsm25_calibrationKeying.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.
BFFC0003 Parameter 3 (number) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_calibrationNext

ViStatus itsm25_calibrationNext (ViSession instrSession, ViUInt16 channel);

Purpose

Description: Continue the next range of calibration procedures.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

Return Value

Reports the status of itsm25_calibrationNext.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_calibrationRange

ViStatus itsm25_calibrationRange (ViSession instrSession, ViUInt16 channel, ViUInt16 range);

Purpose

Description: Calibration range setting.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

range

Variable Type ViUInt16

Description: Sets the calibration range or function for the calibration mode.

Valid Range: 0 - 500 mV
1 - 5 V
2 - 25 V
3 - 1 µA
4 - 10 µA
5 - 100 µA
6 - 1 mA
7 - 10 mA
8 - 100 mA
9 - 1 A
10 - Compliance D/A for V Loop
11 - Compliance D/A for I Loop

Default Value: 0 - 500 mV

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Return Value

Reports the status of itsm25_calibrationRange.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.
BFFC0003 Parameter 3 (range) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_calibrationRead

ViStatus itsm25_calibrationRead (ViSession instrSession, ViUInt16 channel, float *calResult);

Purpose

Description: Read back a float value in calibration mode.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

calResult

Variable Type float (passed by reference)

Description: Get a float value from the instrument in calibration mode.

Return Value

Reports the status of itsm25_calibrationReadAD.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_calibrationSave

ViStatus itsm25_calibrationSave (ViSession instrSession, ViUInt16 channel);

Purpose

Description: Store calibration results to EEPROMS.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

Return Value

Reports the status of itsm25_calibrationSave.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).

BFFF004E Invalid address specified.

BFFF0051 Invalid offset specified.

BFFF0054 Specified offset is not accessible from this hardware.

BFFF0067 Operation is not supported on this session.

BFFF0070 The specified offset is not properly aligned for the access width of the operation.

BFFF0076 Specified width is not supported by this hardware.

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itsm25_calibrationStop

ViStatus itsm25_calibrationStop (ViSession instrSession, ViUInt16 channel);

Purpose

Description: Force stop calibration of a certain range or the full calibration procedures and return to main setting.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

Return Value

Reports the status of itsm25_calibrationStop.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_calibrationCommonMode

```
ViStatus itsm25_calibrationCommonMode (ViSession instrSession,ViUInt16 channel,
ViUInt16 range);
```

Purpose

Description: Process into common mode calibration procedures.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

range

Variable Type ViUInt16

Description: Sets the current range used for common mode calibration.

Valid Range: 0 - 1µA
1 - 10µA
2 - 100µA
3 - 1 mA
4 - 10mA
5 - 100mA
6 - 1A

Default Value: 6 - 1 A

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Return Value

Reports the status of itsm25_calibrationRange.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFC0003	Parameter 3 (range) out of range.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_close

ViStatus itsm25_close (ViSession instrSession);

Purpose

This function performs the following operations: viClose (instrSession) and viClose (rmSession).

Notes:

(1) The instrument must be reinitialized to use it again.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

Return Value

Reports the status of itsm25_close.

———————————————————————————————-

0 No error (the call was successful).

BFFF0000 Miscellaneous or system error occurred.
BFFF000E Invalid object or session handle.
BFFF000F Resource locked for the specified access.
BFFF0015 Time Out expired before operation completed.
BFFF0034 Violation of raw write protocol occurred.
BFFF0035 Violation of raw read protocol occurred.
BFFF0036 Device reported an output protocol error.
BFFF0037 Device reported an input protocol error.
BFFF0038 Bus error occurred during transfer.
BFFF0067 Operation is not supported on this session.

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itsm25_error_message

ViStatus itsm25_error_message (ViSession instrSession, ViStatus *status_code, ViChar message []);

Purpose — This function takes the Status Code returned by the instrument driver functions, interprets it and returns it as a user readable string.

Parameter List

instrSession

Variable Type — ViSession

Description: — Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

status_code

Variable Type — ViStatus (passed by reference)

Description: — Pass the status parameter that is returned from any of the instrument driver functions.

message

Variable Type — ViChar[]

Description: — Returns the user-readable message string that corresponds to the status code you specify.

Return Value

Reports the status of itsm25_error_message.

0	No error (the call was successful).
BFFF0000	Miscellaneous or system error occurred.
BFFF000E	Invalid object or session handle.
BFFF000F	Resource locked for the specified access.
BFFF0015	Time Out expired before operation completed.
BFFF0034	Violation of raw write protocol occurred.
BFFF0035	Violation of raw read protocol occurred.
BFFF0036	Device reported an output protocol error.
BFFF0037	Device reported an input protocol error.
BFFF0038	Bus error occurred during transfer.
BFFF0067	Operation is not supported on this session.

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itsm25_error_query

ViStatus itsm25_error_query (ViSession instrSession, ViInt32 *errorCode, ViChar errorMessage[]);

Purpose

This function reads an error code from the instrument's error queue.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

errorCode

Variable Type ViInt32 (passed by reference)

Description: This output returns the error code read from the instrument error queue.

errorMessage

Variable Type ViChar[]

Description: This output returns the error message string read from the instrument's error message queue.

Return Value

Reports the status of itsm25_error_query.

Status	Description
3FFC0104	Error Query not supported - VI_WARN_NSUP_ERROR_QUERY

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itsm25_getAverageReading

ViStatus itsm25_getAverageReading (ViSession instrSession, ViUInt16 channel,
ViUInt16 *reading);

Purpose

Description: This function retrieves the number of average readings of the specified channel.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

reading

Variable Type ViUInt16 (passed by reference)

Description: The number of average readings.

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Return Value

Reports the status of itsm25_getAverageReading.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_getBias

ViStatus itsm25_getBias (ViSession instrSession, ViUInt16 channel, float *bias);

Purpose

Description This function retrieves the bias value of the specified channel.

Parameter List

instrSession

Variable Type: ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

bias

Variable Type float (passed by reference)

Description: Bias value. It can be voltage(V) or current(A) value, dependent on the current function(Force V Measure I or Force I Measure V) of the module.

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Return Value

Reports the status of itsm25_getBias.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_getBiasDelay

ViStatus itsm25_getBiasDelay (ViSession instrSession, ViUInt16 channel, ViUInt32 *biasDelay);

Purpose

Description: This function retrieves the bias delay of the specified channel.

Parameter List

instrSession

Variable Type: ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type: ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

biasDelay

Variable Type ViUInt32 (passed by reference)

Description: Bias Delay. It can be voltage(V) or current(A) value, dependent on the current function(Force V Measure I or Force I Measure V) of the module.

Return Value

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Reports the status of itsm25_getBiasDelay.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_getBiasFunction

ViStatus itsm25_getBiasFunction (ViSession instrSession, ViUInt16 channel, ViUInt16 *biasFunction);

Purpose

Description: This function retrieves the bias function of the specified channel.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

biasFunction

Variable Type ViUInt16 (passed by reference)

Description: Gets the setting of compare function.

Result:
0 - Off
1 - On

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Return Value

Reports the status of itsm25_getBiasFunction.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_getCompareFunction

ViStatus itsm25_getCompareFunction (ViSession instrSession, ViUInt16 channel, ViUInt16 *compareFunction);

Purpose

Description: This function retrieves the compare function of the specified channel.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

compareFunction

Variable Type ViUInt16 (passed by reference)

Description: Gets the setting of compare function.

Result:
0 - Disable
1 - Enable

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Return Value

Reports the status of itsm25_getCompareFunction.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_getCompliance

ViStatus itsm25_getCompliance (ViSession instrSession, ViUInt16 channel, float *compliance);

Purpose

Description: This function retrieves the compliance value of the specified channel.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

compliance

Variable Type float (passed by reference)

Description: Compliance value. It can be voltage(V) or current (A) value, dependent on the current function (Force V Measure I or Force I Measure V) of the module.

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Return Value

Reports the status of itsm25_getCompliance.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_getDCFixedValue

ViStatus itsm25_getDCFixedValue (ViSession instrSession, ViUInt16 channel, float *dcFixed);

Purpose

Description: This function retrieves the DC/Fixed command value of the specified channel.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

dcFixed

Variable Type float (passed by reference)

Description: DC/Fixed command value. It can be voltage(V) or current(A) value, dependent on the current function (Force V Measure I or Force I Measure V) of the module.

Return Value

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Reports the status of itsm25_getDCFixedValue.

---

0 No error (the call was successful).

BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_getDefaultDelay

ViStatus itsm25_getDefaultDelay (ViSession instrSession, ViUInt16 channel, ViUInt16 *defaultDelay);

Purpose

Description: This function retrieves the default delay of the specified channel.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

defaultDelay

Variable Type: ViUInt16 (passed by reference)

Description: Gets the setting of default delay.

Result:
0 - Off
1 - On

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Return Value

Reports the status of itsm25_getDefaultDelay.

---

0 No error (the call was successful).

BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware

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itsm25_getFifoStatus

ViStatus itsm25_getFifoStatus (ViSession instrSession, ViUInt16 channel, ViUInt16 *full, ViUInt16 *half, ViUInt16 *empty, ViUInt16 *cmpPass, ViUInt16 *reading);

Purpose

Description: This function retrieves the status of the FIFO and the number of FIFO reading.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

full

Variable Type ViUInt16 (passed by reference)

Description: Gets the status of FIFO Full.

Result:

0 - FIFO is full

1 - FIFO is not full

half

Variable Type ViUInt16 (passed by reference)

Description: Gets the status of FIFO Half.

Result :

0 - FIFO is half

1 - FIFO is not half

empty

Variable Type ViUInt16 (passed by reference)

Description: Gets the status of FIFO Empty.

Result :

0 - FIFO is empty

1 - FIFO is not empty

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cmpPass

Variable Type ViUInt16 (passed by reference)

Description: Gets the status if the first reading in FIFO is passed the window compare process.

Result :

0 - Not Passed

1 - passed

reading

Variable Type ViUInt16 (passed by reference)

Description: Gets the number of FIFO reading.

Return Value

Reports the status of itsm25_getFifoStatus.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).

BFFF004E Invalid address specified.

BFFF0051 Invalid offset specified.

BFFF0054 Specified offset is not accessible from this hardware.

BFFF0067 Operation is not supported on this session.

BFFF0070 The specified offset is not properly aligned for the access width of the operation.

BFFF0076 Specified width is not supported by this hardware.

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itsm25_getIntegralRate

ViStatus itsm25_getIntegralRate (ViSession instrSession, ViUInt16 channel, ViUInt16*integralRate);

Purpose

Description: This function retrieves the integral rate of the specified channel.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

integralRate

Variable Type ViUInt16 (passed by reference)

Description: Gets the setting of integral rate.

Result:

0 - Fast
1 - Medium
2 – Slow (60Hz)
3 – Slow (50Hz)

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Return Value

Reports the status of itsm25_getIntegralRate.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_getLowerLimit

ViStatus itsm25_getLowerLimit (ViSession instrSession, ViUInt16 channel, float *lowerLimit);

Purpose

Description: This function retrieves the lower limit of the Window Comparator of the specified channel.

Parameter List

instrSession

Variable Type: ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type: ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

lowerLimit

Variable Type: float (passed by reference)

Description: Lower limit of the Window Comparator. It can be voltage(V) or current(A) value, dependent on the current function(Force V Measure I or Force I Measure V) of the module.

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Return Value

Reports the status of itsm25_getLowerLimit.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_getMeasurementReading

ViStatus itsm25_getMeasurementReading (ViSession instrSession, ViUInt16 channel, ViUInt16 *reading);

Purpose

Description: This function retrieves the number of measurement readings of the specified channel.

Parameter List

instrSession

Variable Type: ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type: ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

reading

Variable Type: ViUInt16 (passed by reference)

Description: The number of measurement readings.

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Return Value

Reports the status of itsm25_getMeasurementReading.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_getSourceRelaySetting

ViStatus itsm25_getSourceRelaySetting (ViSession instrSession, ViUInt16 channel, ViUInt16 *measRange, ViUInt16 *SWauto, ViUInt16 *outSW, ViUInt16 *guard, ViUInt16 *sense, ViUInt16 *ground, ViUInt16 *vrange, ViUInt16 *irange);

Purpose

Description: This function retrieves the settings of the voltage range, current range, and the relays.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

measRange

Variable Type ViUInt16 (passed by reference)

Description: Gets the status of measure range selection.

Result :

0 - Fixed
1 - Auto

SWauto

Variable Type ViUInt16 (passed by reference)

Description: Gets the status of Switch setup.

Result :

0 - Auto
1 - Manual

outSW

Variable Type ViUInt16 (passed by reference)

Description: Gets the status of output switch setup.

Result:

0 - Off
1 - On

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guard

Variable Type ViUInt16 (passed by reference)

Description: Gets the mode of guard setup.

Result :

0 - Off
1 - On

sense

Variable Type ViUInt16 (passed by reference)

Description: Gets the status of the sense switch.

Result :

0 - Local
1 - Remote

ground

Variable Type ViUInt16 (passed by reference)

Description: Gets the status of the ground switch.

Result :

0 - Remote
1 - Local

vrange

Variable Type ViUInt16 (passed by reference)

Description: Gets the current range of voltage.

Result :

0 - 500mV
1 - 5V
2 - 25V

irange

Variable Type ViUInt16 (passed by reference)

Description: Gets the current range of current.

Result :

0 - 1µA
1 - 10µA
2 - 100µA
3 - 1mA
4 - 10mA
5 - 100mA
6 - 1A

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Return Value

Reports the status of itsm25_getSourceRelaySetting.

---

0 No error (the call was successful).
BFFC0002 Parameter 2 (channel) out of range.
BFFF0803 DSP returns wrong query command.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF0806 CH1 is not ready for VXI to read.
BFFF0807 CH2 is not ready for VXI to read.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_getStatusReg

ViStatus itsm25_getStatusReg (ViSession instrSession, ViBoolean *a24Active,
ViBoolean *modid, ViBoolean *ch1Opr,
ViBoolean *ch1Cmp, ViBoolean *ch1NoErr,
ViBoolean *ch1QRRdy, ViBoolean *ch1CPRdy,
ViBoolean *ch2Opr, ViBoolean *ch2Cmp,
ViBoolean *ch2NoErr, ViBoolean *ch2QRRdy,
ViBoolean *ch2CPRdy, ViBoolean *ready,
ViBoolean *passed, ViBoolean *extPower,
ViBoolean *ch2Inst);

Purpose

Description: This function gets the status in the Status Register of the module.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

a24Active

Variable Type ViBoolean (passed by reference)

Description: The bit reflects the state of the Control Register's A24 bit.

Result:

0 - A24 address space can't be accessed

1 - A24 address space can be accessed

modid

Variable Type ViBoolean (passed by reference)

Description: The bit indicates the card is selected via the P2 MODID line.

Result :

0 - Not selected via the P2 MODID line

1 - Selected via the P2 MODID line

ch1Opr

Variable Type ViBoolean (passed by reference)

Description: Gets the status of ch1 operation status.

Result:

0 - Ch1 is not operating

1 - Ch1 is operating

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ch1Cmp

Variable Type ViBoolean (passed by reference)

Description: Gets the status of ch1 passed the window compare process.

Result:

0 - Not passed

1 - Passed

ch1NoErr

Variable Type ViBoolean (passed by reference)

Description: Gets the status of ch1 error.

Result:

0 - Error

1 - No Error

ch1QRRdy

Variable Type ViBoolean (passed by reference)

Description: Indicates that data returned by a query command in CH1 is available in the Query Response Register.

Result:

0 - No data

1 - Data is available

ch1CPRdy

Variable Type ViBoolean (passed by reference)

Description: Indicates that a command or op code in CH1 can be written to the Command or Parameter Register.

Result:

0 – Can't write to the register

1 - Command or op code can be written to the Register

ch2Opr

Variable Type ViBoolean (passed by reference)

Description: Gets the status of ch2 operation status.

Result:

0 - Ch2 is not operating

1 - Ch2 is operating

ch2Cmp

Variable Type ViBoolean (passed by reference)

Description: Gets the status of ch2 passed the window compare process.

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Result:

0 - Not passed

1 - Passed

ch2NoErr

Variable Type ViBoolean (passed by reference)

Description: Gets the status of ch2 error.

Result:

0 - Error

1 - No Error

ch2QRRdy

Variable Type ViBoolean (passed by reference)

Description: Indicates that data returned by a query command in CH2 is available in the Query Response Register.

Result:

0 - No data

1 - Data is available

ch2CPRdy

Variable Type ViBoolean (passed by reference)

Description: Indicates that a command or op code in CH2 can be written to the Command or Parameter Register.

Result:

0 – Can't write to the register

1 - Command or op code can be written to the Register

ready

Variable Type ViBoolean (passed by reference)

Description: Gets the status of the module whether it has completed the initialization process.

Result:

0 - Not complete the process yet

1 - Complete initialization process

passed

Variable Type ViBoolean (passed by reference)

Description: Gets the status of the module that indicates the reset has finished or the self-test passed.

Result:

0 - Is executing a reset or has failed self-test

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1 - Reset has finished or the self-test passed

extPower

Variable Type ViBoolean (passed by reference)

Description: Gets the status of the module that uses the external power supply to drive output load.

Result:

0 - Using external power supply

1 - Not using external power supply

ch2Inst

Variable Type ViBoolean (passed by reference)

Description: Gets the status of the module that indicates CH2 is inside the module.

Result:

0 - Ch2 inside the module

1 - Ch2 not inside the module

Return Value

Reports the status of Description: itsm25_getStatusReg.

---

0 No error (the call was successful).

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).

BFFF004E Invalid address specified.

BFFF0051 Invalid offset specified.

BFFF0054 Specified offset is not accessible from this hardware.

BFFF0067 Operation is not supported on this session.

BFFF0070 The specified offset is not properly aligned for the access width of the operation.

BFFF0076 Specified width is not supported by this hardware

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itsm25_getSweepStart

ViStatus itsm25_getSweepStart (ViSession instrSession, ViUInt16 channel, float *sweepStart);

Purpose

Description: This function retrieves the start value of the specified channel in sweep mode.

Parameter List

instrSession

Variable Type: ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type: ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

sweepStart

Variable Type: float (passed by reference)

Description: Start value in sweep mode. It can be voltage(V) or current(A) value, dependent on the current function(Force V Measure I or Force I Measure V) of the module.

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Return Value

Reports the status of itsm25_getSweepStart.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_getSweepSteps

ViStatus itsm25_getSweepSteps (ViSession instrSession, ViUInt16 channel, ViUInt16 *logStep, ViUInt16 *linearStep);

Purpose

Description: This function retrieves the settings of the log steps and linear steps for sweep mode.

Parameter List

instrSession

Variable Type: ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type: ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range:
1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

logStep

Variable Type: ViUInt16 (passed by reference)

Description: Gets the setting of sweep log steps.

Result:

0 - 5 points/decade
1 - 10 points/decade
2 - 25 points/decade
3 - 50 points/decade

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linearStep

Variable Type ViUInt16 (passed by reference)

Description: Gets the setting of sweep linear steps.

Return Value

Reports the status of itsm25_getSweepSteps.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware

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itsm25_getSweepStop

ViStatus itsm25_getSweepStop (ViSession instrSession, ViUInt16 channel, float *sweepStop);

Purpose

Description: This function retrieves the stop value of the specified channel in sweep mode.

Parameter List

instrSession

Variable Type: ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type: ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

sweepStop

Variable Type: float (passed by reference)

Description: Stop value in sweep mode. It can be voltage(V) or current(A) value, dependent on the current function(Force V Measure I or Force I Measure V) of the module.

Return Value

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Reports the status of itsm25_getSweepStop.

---

0 No error (the call was successful).

BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_getTemperature

ViStatus itsm25_getTemperature (ViSession instrSession, ViUInt16 channel, float *temperature);

Purpose

Description: This function retrieves the temperature of driver.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

temperature

Variable Type float (passed by reference)

Description: Temperature of the driver circuit in centigrade.

Return Value

Reports the status of itsm25_getTemperature.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.

BFFF0803 DSP returns wrong query command.

BFFF0804 CH1 is not ready for VXI to write.

BFFF0805 CH2 is not ready for VXI to write.

BFFF0806 CH1 is not ready for VXI to read.

BFFF0807 CH2 is not ready for VXI to read.

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).

BFFF004E Invalid address specified.

BFFF0051 Invalid offset specified.

BFFF0054 Specified offset is not accessible from this hardware.

BFFF0067 Operation is not supported on this session.

BFFF0070 The specified offset is not properly aligned for the access width of the operation.

BFFF0076 Specified width is not supported by this hardware.

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itsm25_getToffTime

ViStatus itsm25_getToffTime (ViSession instrSession, ViUInt16 channel, ViUInt16 *toff);

Purpose

Description: This function retrieves the Toff time of the specified channel.

Parameter List

instrSession

Variable Type: ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type: ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

toff

Variable Type: ViUInt16 (passed by reference)

Description: The Toff time in ms.

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Return Value

Reports the status of itsm25_getToffTime.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_getTonTime

ViStatus itsm25_getTonTime (ViSession instrSession, ViUInt16 channel,ViUInt16 *ton);

Purpose

Description: This function retrieves the Ton time of the specified channel.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

ton

Variable Type ViUInt16 (passed by reference)

Description: The Ton time in ms.

Return Value

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Reports the status of itsm25_getTonTime.

---

0 No error (the call was successful).

BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_getTrigger

ViStatus itsm25_getTrigger (ViSession instrSession, ViUInt16 channel,
ViUInt16 *triggerInEnable, ViUInt16 *triggerInMode,
ViUInt16 *triggerInTimer, ViUInt16 *triggerInCount,
ViUInt16 *triggerSource, ViUInt16 *triggerOutEnable,
ViUInt16 *triggerOutTiming, ViUInt16 *triggerOutput);

Purpose

Description: This function retrieves the trigger settings.

Parameter List

instrSession

Variable Type: Session

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range 1 - Channel 1
2 - Channel 2

Default Value 1 - Channel 1

triggerInEnable

Variable Type ViUInt16 (passed by reference)

Description: Gets the trigger input function of the module.

Result:
0 - Disable
1 - Enable

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triggerInMode

Variable Type ViUInt16 (passed by reference)

Description: Gets the trigger input mode of the instrument.

Result:
0 - Continuous
1 - Count

triggerInTimer

Variable Type ViUInt16 (passed by reference)

Description: Gets the number of the input triggers. The trigger input timer allows 0~255 triggers to start one operation.

triggerInCount

Variable Type ViUInt16 (passed by reference)

Description: Gets the number of the input trigger counts.

triggerSource

Variable Type ViUInt16 (passed by reference)

Description: Gets the input trigger source of the module.

Result :
0 - TTLTRG0
1 - TTLTRG1
2 - TTLTRG2
3 - TTLTRG3
4 - TTLTRG4
5 - TTLTRG5
6 - TTLTRG6
7 - TTLTRG7

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triggerOutEnable

Variable Type ViUInt16 (passed by reference)

Description: Gets the trigger output function of the module.

Result:
0 - Disable
1 - Enable

triggerOutTiming

Variable Type ViUInt16 (passed by reference)

Description: Gets the trigger output timing of the module.

Result:
0 - Start of each step
1 - End of each step
2 - Start of each operation
3 - End of each operation
4 - Window Compare Pass
5 - Window Compare Fail

triggerOutput

Variable Type ViUInt16 (passed by reference)

Description: Gets the trigger output of the instrument.

Result:
0 - TTLTRG0
1 - TTLTRG1
2 - TTLTRG2
3 - TTLTRG3
4 - TTLTRG4
5 - TTLTRG5
6 - TTLTRG6
7 - TTLTRG7

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Return Value

Reports the status of itsm25_getTrigger.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_getUpperLimit

ViStatus itsm25_getUpperLimit (ViSession instrSession, ViUInt16 channel, float *upperLimit);

Purpose

Description: This function retrieves the upper limit of the Window Comparator of the specified channel.

Parameter List

instrSession

Variable Type: ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type: ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

upperLimit

Variable Type: float (passed by reference)

Description: Upper limit of the Window Comparator. It can be voltage(V) or current(A) value, dependent on the current function(Force V Measure I or Force I Measure V) of the module.

Return Value

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Reports the status of itsm25_getUpperLimit.

---

0 No error (the call was successful).

BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_getWorkModeFunction

ViStatus itsm25_getWorkModeFunction (ViSession instrSession, ViUInt16 channel, ViUInt16 *function, ViUInt16 *block, ViUInt16 *shape, ViUInt16 *mode);

Purpose

Description: This function retrieves the settings of the Function, Block, Shape and Mode of a specified channel.

Parameter List

instrSession

Variable Type: ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type: ViUInt16

Description: Selects channel of the instrument to be control.

Valid Range:
1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

function

Variable Type: ViUInt16 (passed by reference)

Description: Gets the function setting of the instrument.

Result:
0 - Force V, Measure I
1 - Force I, Measure V

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block

Variable Type ViUInt16 (passed by reference)

Description: Gets the block setting of the instrument.

Result:
0 - OFF
1 - ON

shape

Variable Type ViUInt16 (passed by reference)

Description: Gets the shape setting of the instrument.

Result:
0 - Continuous
1 - Pulse

mode

Variable Type ViUInt16 (passed by reference)

Description Gets the mode setting of the instrument.

Result :
0 - DC
1 - Fixed
2 - Sweep(Linear)
3 - Sweep(Log)
4 - Append

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Return Value

Reports the status of itsm25_getWorkModeFunction.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFF0803	DSP returns wrong query command.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0806	CH1 is not ready for VXI to read.
BFFF0807	CH2 is not ready for VXI to read.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_init

ViStatus itsm25_init (ViRsrc rsrcName, ViBoolean idquery, ViBoolean resetinstr, ViSession *instrSession);

Purpose

Description Performs the following initialization actions:

- Opens a session to the Default Resource Manager resource and a session to the specified device using the interface and address specified in the Resource Name control.
- Performs an identification query on the Instrument. (Optional)
- Resets the instrument to a known state. (Optional)
- Returns an Instrument Handle that is used to differentiate between different sessions of this instrument driver.
- Each time this function is invoked, a Unique Session is opened. It is possible to have more than one session open for the same resource.

Parameter List

rsrcName

Variable Type ViRsrc

This control specifies the interface and address of the device that is to be initialized (Instrument Descriptor). The exact grammar to be used in this control is shown in the note below.

Default Value: "VXIO::3::INSTR"

Notes:

Based on the Instrument Descriptor, this operation establishes a communication session with a device. The grammar for the Instrument Descriptor is shown below. Optional parameters are shown in square brackets ([]).

Interface	Syntax
VXI	VXI[board]::VXI logical address[::INSTR]

The VXI keyword is used for VXI instruments via either embedded MXIbus or Firewire (IEEE-1394)controllers.

The default values for optional parameter board is 0.

idquery

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Variable Type ViBoolean

This control specifies if an ID Query is sent to the instrument during the initialization procedure.

Valid Range:

VI_OFF (0) - Skip Query

VI_ON (1) - Do Query (Default Value)

resetinstr

Variable Type ViBoolean

This control specifies if the instrument is to be reset to its power-on settings during the initialization procedure.

Valid Range:

VI_OFF (0) - Don't Reset

VI_ON(1) - Reset Device (Default Value)

Notes:

If you do not want the instrument reset. Set this control to"Don't Reset" while initializing the instrument.

instrSession

Variable Type ViSession (passed by reference)

This control returns an Instrument Handle that is used in all subsequent function calls to differentiate between different sessions of this instrument driver.

Notes:

Each time this function is invoked a Unique Session is opened. It is possible to have more than one session open for the same resource.

Return Value

This control contains the status code returned by the function call.

Status Codes:

Status	Description
0	No error (the call was successful).
3FFC0101	ID Query not supported - VI_WARN_NSUP_ID_QUERY
3FFC0102	Reset not supported - VI_WARN_NSUP_RESET
3FFC0103	Self Test not supported - VI_WARN_NSUP_SELF_TEST
3FFC0104	Error Query not supported - VI_WARN_NSUP_ERROR_QUERY
3FFC0105	Revision Query not supported - VI_WARN_NSUP_REV_QUERY
3FFF0005	The specified termination character was read.
3FFF0006	The specified number of bytes was read.

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BFFC0001	Parameter 1 out of range. (String not range checked)
BFFC0002	Parameter 2 (ID Query) out of range.
BFFC0003	Parameter 3 (Reset Device) out of range.
BFFC0011	Instrument returned invalid response to ID Query
BFFF0000	Miscellaneous or system error occurred.
BFFF000E	Invalid session handle.
BFFF0015	Timeout occurred before operation could complete.
BFFF0034	Violation of raw write protocol occurred.
BFFF0035	Violation of raw read protocol occurred.
BFFF0036	Device reported an output protocol error.
BFFF0037	Device reported an input protocol error.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Invalid setup (attributes are not consistent).
BFFF005F	No listeners condition was detected.
BFFF0060	This interface is not the controller in charge.
BFFF0067	Operation is not supported on this session.

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itsm25_operationStartArmedTrig

ViStatus itsm25_operationStartArmedTrig (ViSession instrSession,
ViUInt16 channel,
ViUInt16 trigInputEnable,
ViUInt16 trigInputMode,
ViUInt16 trigInputTimer,
ViUInt16 trigInputCount,
ViUInt16 trigSource,
ViUInt16 trigOutputEnable,
ViUInt16 trigOutputTiming,
ViUInt16 trigOutput);

Purpose

Description: Starts all specified activities when the specified trigger event occurs.

Parameter List

instrSession

Variable Type ViSession

Description Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

trigInputEnable

Variable Type ViUInt16

Description: Select the trigger input function of the module.

Valid Range: 0 - Disable
1 - Enable

Default Value: 0 - Disable

trigInputMode

Variable Type ViUInt16

Description: Select the trigger input mode of the module.

Valid Range: 0 - continuous
1 - count

Default Value: 0 - continuous

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trigInputTimer

Variable Type ViUInt16

Description: Sets the number of the input triggers. The trigger input timer allows 0~255 triggers to start one operation.

Valid Range: 1 to 255

Default Value: 1

trigInputCount

Variable Type ViUInt16

Description: Sets the number of the input trigger counts. Each trigger can generate one operation.

Valid Range: 1 to 255

Default Value: 1

trigSource

Variable Type ViUInt16

Description Select an input trigger source from TTLTRG0 ~ TTLTRG7 or Another Channel.

Valid Range:
0 - TTLTRG0
1 - TTLTRG1
2 - TTLTRG2
3 - TTLTRG3
4 - TTLTRG4
5 - TTLTRG5
6 - TTLTRG6
7 - TTLTRG7

Default Value: 0 - TTLTRG0

trigOutputEnable

Variable Type ViUInt16

Description: Select the trigger output function of the module.

Valid Range:
0 - Disable
1 - Enable

Default Value: 0 - Disable

trigOutputTiming

Variable Type ViUInt16

Description: Select the trigger output timing of the module.

Valid Range:
0 - Start of each step
1 - End of each step
2 - Start of each operation
3 - End of each operation
4 - Window Compare Pass
5 - Window Compare Fail

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Default Value: 0 - Start of each step

trigOutput

Variable Type ViUInt16

Description: Select a trigger source from TTLTRG0 ~ TTLTRG7 or Another Channel.

Valid Range:
0 - TTLTRG0
1 - TTLTRG1
2 - TTLTRG2
3 - TTLTRG3
4 - TTLTRG4
5 - TTLTRG5
6 - TTLTRG6
7 - TTLTRG7

Default Value: 0 - TTLTRG0

Return Value

Reports the status of itsm25_operationStartArmedTrig.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFC0003	Parameter 3 (trigOutput) out of range.
BFFC0004	Parameter 4 (trigInputMode) out of range.
BFFC0005	Parameter 5 (trigInputTimer) out of range.
BFFC0006	Parameter 6 (trigInputCount) out of range.
BFFC0007	Parameter 7 (trigSource) out of range.
BFFC0008	Parameter 8 (trigOutputEnable) out of range.
BFFC0009	Parameter 9 (trigOutputTiming) out of range.
BFFC0010	Parameter 10 (trigOutput) out of range.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_operationStartImm

ViStatus itsm25_operationStartImm (ViSession instrSession, ViUInt16 channel);

Purpose

Description: Starts all specified activities immediately.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

Return Value

Reports the status of itsm25_operationStartImm.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.

BFFF0804 CH1 is not ready for VXI to write.

BFFF0805 CH2 is not ready for VXI to write.

3FFF0810 CH1 is operating now.

3FFF0811 CH2 is operating now.

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).

BFFF004E Invalid address specified.

BFFF0051 Invalid offset specified.

BFFF0054 Specified offset is not accessible from this hardware.

BFFF0067 Operation is not supported on this session.

BFFF0070 The specified offset is not properly aligned for the access width of the operation.

BFFF0076 Specified width is not supported by this hardware.

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itsm25_operationStop

ViStatus itsm25_operationStop (ViSession instrSession, ViUInt16 channel);

Purpose

Description: tops all running activities and sets the module to standby mode.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

Return Value

Reports the status of itsm25_operationStop.

---

0 No error (the call was successful).

BFFC000 Parameter 2 (channel) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_readCurrent

ViStatus itsm25_readCurrent (ViSession instrSession, ViUInt16 channel, float *current);

Purpose

Description: Gets the reading of the current of the module in amps.

Parameter List

instrSession

Variable Type ViSession

Description Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

current

Variable Type float (passed by reference)

Description: Get the current values from the instrument.

Return Value

Reports the status of itsm25_readCurrent.

---

0 No error (the call was successful).
BFFC0002 Parameter 2 (channel) out of range.
BFFF0803 DSP returns wrong query command.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF0806 CH1 is not ready for VXI to read.
BFFF0807 CH2 is not ready for VXI to read.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_readFIFOBlock

ViStatus itsm25_readFIFOBlock (ViSession instrSession, ViUInt16 channel, ViUInt16 number, float voltage [], float current []);

Purpose

Description: Gets the voltage and current data array in FIFO with VISA block operation.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

number

Variable Type ViUInt16

Description: Tells the system the number of V and I values in FIFO.

Valid Range: 1 to 64

Default Value: 1

voltage

Variable Type float []

Description: Get the voltage array in FIFO.

current

Variable Type float []

Description: Get the current array in FIFO.

Return Value

Reports the status of itsm25_readFIFOBlock.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.

BFFC0003 Parameter 3 (number) out of range.

BFFF0812 FIFO reading is less than the number to read in block operation.

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

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BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_readFIFOData

ViStatus itsm25_readFIFOData (ViSession instrSession, ViUInt16 channel, float *voltage, float *current);

Purpose

Description: Gets the voltage and current values in FIFO.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

voltage

Variable Type float (passed by reference)

Description: Get the voltage value in FIFO.

current

Variable Type float (passed by reference)

Description: Get the current value in FIFO.

Return Value

Reports the status of itsm25_readFIFOData.

———————————————————————————————-

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.

BFFF0808 FIFO count is less than 4, no enough data for VXI to read.

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).

BFFF004E Invalid address specified.

BFFF0051 Invalid offset specified.

BFFF0054 Specified offset is not accessible from this hardware.

BFFF0067 Operation is not supported on this session.

BFFF0070 The specified offset is not properly aligned for the access width of the operation.

BFFF0076 Specified width is not supported by this hardware.

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itsm25_readInst

ViStatus itsm25_readInst (ViSession instrSession, ViInt16 reg, ViInt16 *value);

Purpose

Given a hexadecimal register number, this function returns the value of the register.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

reg

Variable Type ViInt16

Description: Number, in hex, of the register to be accessed.

Valid Range: 0x00 ~ 0x2F

Default Value: 0x00

value

Variable Type ViInt16 (passed by reference)

Description: Displays the hex value of byte queried.

Return Value

Reports the status of itsm25_readInst.

———————————————————————————————-

0 No erro (the call was successful).

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).

BFFF004E Invalid address specified.

BFFF0051 Invalid offset specified.

BFFF0054 Specified offset is not accessible from this hardware.

BFFF0067 Operation is not supported on this session.

BFFF0070 The specified offset is not properly aligned for the access width of the operation.

BFFF0076 Specified width is not supported by this hardware.

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itsm25_readSharedMemory

ViStatus itsm25_readSharedMemory (ViSession instrSession, ViUInt16 channel, ViUInt16 reading, float voltage [], float current []);

Purpose

Description: Gets the voltage and current values in A24 shared memory.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

reading

Variable Type ViUInt16

Description: Sets the number of measurement readings.

Range: 1 to 128

Default Value: 1

voltage

Variable Type float []

Description: Get a set of voltage values from the A24 shared memory.

current

Variable Type float []

Description: Get a set of current values from the A24 shared memory.

Return Value

Reports the status of itsm25_readSharedMemory.

———————————————————————————————-

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.

BFFC0003 Parameter 3 (reading) out of range.

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

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BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.
BFFF0083 Invalid length specified.

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itsm25_readVoltage

ViStatus itsm25_readVoltage (ViSession instrSession, ViUInt16 channel, float *voltage);

Purpose

Description: Gets the reading of the voltage of the module in volts.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

voltage

Variable Type float (passed by reference)

Description: Get the voltage values from the instrument.

Return Value

Reports the status of itsm25_readVoltage.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.
BFFF0803 DSP returns wrong query command.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF0806 CH1 is not ready for VXI to read.
BFFF0807 CH2 is not ready for VXI to read.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_reset

ViStatus itsm25_reset (ViSession instrSession);

Purpose

This function resets the instrument to a known state and sends initialization commands to the instrument that sets any necessary programmatic variables such as Headers Off, Short Command form, and Data Transfer Binary to the state necessary for the operation of the instrument driver.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

Return Value

Reports the status of itsm25_reset.

———————————————————————————————-

0 No error (the call was successful).

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).

BFFF004E Invalid address specified.

BFFF0051 Invalid offset specified.

BFFF0054 Specified offset is not accessible from this hardware.

BFFF0067 Operation is not supported on this session.

BFFF0070 The specified offset is not properly aligned for the access width of the operation.

BFFF0076 Specified width is not supported by this hardware.

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itsm25_resetChannel

ViStatus itsm25_resetChannel (ViSession instrSession, ViUInt16 channel);

Purpose

Description: Reset one channel (channel 1 or 2) inside the module only.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

Return Value

Reports the status of itsm25_resetChannel.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).

BFFF004E Invalid address specified.

BFFF0051 Invalid offset specified.

BFFF0054 Specified offset is not accessible from this hardware.

BFFF0067 Operation is not supported on this session.

BFFF0070 The specified offset is not properly aligned for the access width of the operation.

BFFF0076 Specified width is not supported by this hardware.

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itsm25_revision_query

ViStatus itsm25_revision_query (ViSession instrSession, ViChar driver_rev[], ViChar instr_rev[]);

Purpose

This function returns the revision numbers of the instrument driver and instrument firmware, and tells the user with which instrument firmware this revision of the driver is compatible.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

driver_rev

Variable Type ViChar[]

Description: Instrument driver revision.

instr_rev

Variable Type ViChar[]

Description: Instrument firmware revision.

Return Value

Reports the status of itsm25_revision_query.

Status	Description
0	No error (the call was successful).
BFFF0000	Miscellaneous or system error occurred.
BFFF000E	Invalid object or session handle.
BFFF000F	Resource locked for the specified access.
BFFF0015	TimeOut expired before operation completed.
BFFF0034	Violation of raw write protocol occurred.
BFFF0035	Violation of raw read protocol occurred.
BFFF0036	Device reported an output protocol error
BFFF0037	Device reported an input protocol error.
BFFF0038	Bus error occurred during transfer.
BFFF0067	Operation is not supported on this session.

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itsm25_self_test

ViStatus itsm25_self_test (ViSession instrSession, ViInt16 *testResult, ViChar testMessage[]);

Purpose

This function runs the instrument's self test routine and returns the test result(s).

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

testResult

Variable Type ViInt16 (passed by reference)

Description: Numeric result from self-test operation.

testMessage

Variable Type ViChar[]

Description: Self-test status message.

Return Value

Reports the status of itsm25_self_test.

Status	Description
3FFC0103	Self-test not supported

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itsm25_setAppendValue

ViStatus itsm25_setAppendValue (ViSession instrSession, ViUInt16 channel, float appendValue);

Purpose

Description: Sets the force value for append mode.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

appendValue

Variable Type float

Description: Sets the append value in amps or in volts dependent on the force mode.

Valid Range: Dependent on source mode:

Force Voltage: -25V to 25V

Force Current: -1.0A to 1.0A

Default Value: 0.0

Return Value

Reports the status of itsm25_setAppendValue.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFC0003	Parameter 3 (dcFixed) out of range.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_setAverage

ViStatus itsm25_setAverage (ViSession instrSession, ViUInt16 channel, ViUInt16 average);

Purpose

Description: Sets the number of readings that are averaged together to filter noise out of the input.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type iUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

average

Variable Type ViUInt16

Description: Sets the number of values that are averaged together to get a measurement.

Valid Range: 1 to 255

Default Value: 1

Return Value

the status of itsm25_setAverage.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.
BFFC0003 Parameter 3 (average) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_setBiasCurrent

ViStatus itsm25_setBiasCurrent (ViSession instrSession, ViUInt16 channel, float biasCurrent);

Purpose

Description: Sets the bias current value.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

biasCurrent

Variable Type float

Description: Sets the output bias in amps if the instrument is in current source mode.

Valid Range: -1A to 1A

Default Value: 0.0

Return Value

Reports the status of itsm25_setBiasCurrent.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.

BFFC0003 Parameter 3 (biasCurrent) out of range.

BFFF0804 CH1 is not ready for VXI to write.

BFFF0805 CH2 is not ready for VXI to write.

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).

BFFF004E Invalid address specified.

BFFF0051 Invalid offset specified.

BFFF0054 Specified offset is not accessible from this hardware.

BFFF0067 Operation is not supported on this session.

BFFF0070 The specified offset is not properly aligned for the access width of the operation.

BFFF0076 Specified width is not supported by this hardware.

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itsm25_setBiasDelay

ViStatus itsm25_setBiasDelay (ViSession instrSession, ViUInt16 channel, unsigned long biasDelay);

Purpose

Description: Sets the bias delay time.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

biasDelay

Variable Type unsigned long

Description: Sets the DC delay in seconds. This is the delay between when the source output is applied to the test circuit and the measurement is taken.

Valid Range: 0 to 4294967295 ms

Default Value: 0 ms

Return Value

Reports the status of itsm25_setBiasDelay.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.

BFFC0003 Parameter 3 (biasDelay) out of range.

BFFF0804 CH1 is not ready for VXI to write.

BFFF0805 CH2 is not ready for VXI to write.

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).

BFFF004E Invalid address specified.

BFFF0051 Invalid offset specified.

BFFF0054 Specified offset is not accessible from this hardware.

BFFF0067 Operation is not supported on this session.

BFFF0070 The specified offset is not properly aligned for the access width of the operation.

BFFF0076 Specified width is not supported by this hardware.

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itsm25_setBiasFunction

ViStatus itsm25_setBiasFunction (ViSession instrSession, ViUInt16 channel, ViUInt16 biasFunction);

Purpose

Description: This function sets the bias function on/off.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

biasFunction

Variable Type ViUInt16

Description: Sets the bias function On or Off.

Valid Range: 0 - Off

1 - On

Default Value: 0 - Off

Return Value

Reports the status of itsm25_setBiasFunction.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.

BFFC0003 Parameter 3 (biasFunction) out of range.

BFFF0804 CH1 is not ready for VXI to write.

BFFF0805 CH2 is not ready for VXI to write.

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).

BFFF004E Invalid address specified.

BFFF0051 Invalid offset specified.

BFFF0054 Specified offset is not accessible from this hardware.

BFFF0067 Operation is not supported on this session.

BFFF0070 The specified offset is not properly aligned for the access width of the operation.

BFFF0076 Specified width is not supported by this hardware.

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itsm25_setBiasVoltage

ViStatus itsm25_setBiasVoltage (ViSession instrSession, ViUInt16 channel, float biasVoltage);

Purpose

Description: Sets bias voltage value.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

biasVoltage

Variable Type float

Description: Sets the output bias in volts if the instrument is in voltage source mode.

Valid Range: -25V to 25V

Default Value: 0.0

Return Value

Reports the status of itsm25_setBiasVoltage.

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.
BFFC0003 Parameter 3 (biasVoltage) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.

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BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_setCompareFunction

ViStatus itsm25_setCompareFunction (ViSession instrSession, ViUInt16 channel, ViUInt16 compareFunction);

Purpose

Description: Sets the compare function to either disable or enable.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

compareFunction

Variable Type ViUInt16

Description: Sets the compare function disable or enable..

Valid Range: 0 - Disable
1 - Enable

Default Value: 0 - Disable

Return Value

Reports the status of itsm25_setCompareFunction.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.
BFFC0003 Parameter 3 (compareFunction) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_setCurrentCompliance

ViStatus itsm25_setCurrentCompliance (ViSession instrSession, ViUInt16 channel, float compliance);

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

compliance

Variable Type float

Description: Sets the measurement compliance in amps. The value should be between 2% ~ 100% of a specified current range.

Valid Range: 0.00000002 to 1.0 A

Default Value: 1.0

Return Value

Reports the status of itsm25_setCurrentCompliance.

———————————————————————————————-

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.

BFFC0003 Parameter 3 (compliance) out of range.

BFFF0804 CH1 is not ready for VXI to write.

BFFF0805 CH2 is not ready for VXI to write.

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).

BFFF004E Invalid address specified.

BFFF0051 Invalid offset specified.

BFFF0054 Specified offset is not accessible from this hardware.

BFFF0067 Operation is not supported on this session.

BFFF0070 The specified offset is not properly aligned for the access width of the operation.

BFFF0076 Specified width is not supported by this hardware.

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itsm25_setDcFixedCommand

ViStatus itsm25_setDcFixedCommand (ViSession instrSession, ViUInt16 channel, float dcFixed);

Purpose

Description: Sets the force value for DC or Fixed mode.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

dcFixed

Variable Type float

Description: Sets the DC/Fixed value in amps or in volts dependent on the force mode.

Valid Range: Dependent on source mode:

Sorce Volatage: -25V to 25V

Force Current: -1.0A to 1.0A

Default Value: 0.0

Return Value

Reports the status of itsm25_setDcFixedCommand.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.

BFFC0003 Parameter 3 (dcFixed) out of range.

BFFF0804 CH1 is not ready for VXI to write.

BFFF0805 CH2 is not ready for VXI to write.

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

FFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).

BFFF004E Invalid address specified.

BFFF0051 Invalid offset specified.

BFFF0054 Specified offset is not accessible from this hardware.

BFFF0067 Operation is not supported on this session.

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BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_setDefaultDelay

ViStatus itsm25_setDefaultDelay (ViSession instrSession, ViUInt16 channel, ViUInt16 defaultDelay);

Purpose

Description: Set default delay when the module is operating.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

defaultDelay

Variable Type ViUInt16

Description: Sets the default delay On or Off.

Valid Range: 0 - Off
1 - On

Default Value: 0 - Off

Return Value

Reports the status of itsm25_setDefaultDelay.

---

0 No error (the call was successful).
BFFC0002 Parameter 2 (channel) out of range.
BFFC0003 Parameter 3 (default Delay) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_setIntegralRate

ViStatus itsm25_setIntegralRate (ViSession instrSession, ViUInt16 channel, ViUInt16 integralRate);

Purpose

Description: Sets the integrated rate.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

integralRate

Variable Type ViUInt16

Description: Set integral rate to Fast, Medium or Slow.

Valid Range: 0 - Fast
1 - Medium
2 - Slow (60 Hz)
3 - Slow (50 Hz)

Default Value: 2 - Slow (60 Hz)

Return Value

Reports the status of itsm25_setIntegralRate.

---

0 No error (the call was successful).

BFFC0002	Parameter 2 (channel) out of range.
BFFC0003	Parameter 3 (integral Rate) out of range.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_setLowerLimit

ViStatus itsm25_setLowerLimit (ViSession instrSession, ViUInt16 channel, float lowerLimit);

Purpose

Description: This function sets the lower limit of the Window Comparator.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

lowerLimit

Variable Type float

Description: Sets the lower limit of the Window Comparator.

Valid Range: Dependent on source mode:

Current Source: -1A to 1A

Voltage Source: -25V to 25V

Default Value: 0.0

Return Value

Reports the status of itsm25_setLowerLimit.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.
BFFC0003 Parameter 3 (lowerLimit) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_setMeasureReading

ViStatus itsm25_setMeasureReading (ViSession instrSession, ViUInt16 channel, ViUInt16 reading);

Purpose

Description: Sets the number of measurement readings.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

reading

Variable Type ViUInt16

Description: Sets the number of measurement readings.

Valid Range: 1 to 8190

Default Value: 1

Return Value

Reports the status of itsm25_setMeasureReading.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.
BFFC0003 Parameter 3 (reading) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_setSourceRangeRelay

ViStatus itsm25_setSourceRangeRelay (ViSession instrSession, ViUInt16 channel,
ViUInt16 vRange, ViUInt16 iRange,
ViUInt16 measRange, ViUInt16 SWAuto,
ViUInt16 outSW, ViUInt16 guard,
ViUInt16 sense, ViUInt16 gnd);

Purpose

Description: This function sets the voltage, current range and the relays.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

vRange

Variable Type ViUInt16

Description: Sets the range used for the value settings when the instrument is in voltage source mode the voltage value is used.

Valid Range: 0 - 500mV
1 - 5V
2 - 25V

Default Value: 2 - 25V

iRange

Variable Type ViUInt16

Description: Sets the range used for the value settings when the instrument is in current source mode the current value is used.

Valid Range: 0 - 1µA
1 - 10µA
2 - 100µA
3 - 1mA
4 - 10mA
5 - 100mA
6 - 1A

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Default Value: 6 - 1A

measRange

Variable Type ViUInt16

Description: Sets the state of the Measure Range to either Fixed or Auto.

Valid Range: 0 - Fixed

1 - Auto

Default Value: 0 - Fixed

SWAuto

Variable Type ViUInt16

Description: Sets the state of the Switch to either Auto or Manual.

Valid Range: 0 - Auto

1 - Manual

Default Value: 0 - Auto

outSW

Variable Type ViUInt16

Description: Sets the output switch to either On or Off.

Valid Range: 0 - Off

1 - On

Default Value: 0 - Off

guard

Variable Type ViUInt16

Description: Sets the output guard to either On or Off.

Valid Range: 0 - Off

1 - On

Default Value: 0 - Off

sense

Variable Type ViUInt16

Description: Sets the output sense to either local or remote.

Valid Range: 0 - Local

1 - Remote

Default Value: 0 - Local

gnd

Variable Type ViUInt16

Description: Sets the output ground to either Local or Remote.

Valid Range: 0 - Remote

1 - Local

Default Value: 1 - Local

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Return Value

Reports the status of itsm25_setSourceRangeRelay.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.
BFFC0003 Parameter 3 (vRange) out of range.
BFFC0004 Parameter 4 (iRange) out of range.
BFFC0005 Parameter 5 (measRangeAuto) out of range.
BFFC0005 Parameter 6 (SWAuto) out of range.
BFFC0006 Parameter 7 (outSW) out of range.
BFFC0007 Parameter 8 (guard) out of range.
BFFC0008 Parameter 9 (sense) out of range.
BFFC0009 Parameter 10 (gnd) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_setSweepLogLinStep

ViStatus itsm25_setSweepLogLinStep (ViSession instrSession, ViUInt16 channel, ViUInt16 logStep, ViUInt16 linearStep);

Purpose

Description: Sets the number of steps in the log or linear operation of the module in sweep mode.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

logStep

Variable Type ViUInt16

Description: Sets the log step value of the waveform.

Valid Range: 0 - 5 points/decade
1 - 10 points/decade
2 - 25 points/decade
3 - 50 points/decade

Default Value: 0 - 5 points/decade

linearStep

Variable Type ViUInt16

Description: Sets the linear step value of the waveform.

Valid Range: 1 to 255

Default Value: 1

Return Value

Reports the status of itsm25_setSweepLogLinStep.

---

0 No error (the call was successful).
BFFC0002 Parameter 2 (channel) out of range.
BFFC0003 Parameter 3 (logStep) out of range.
BFFC0004 Parameter 4 (linearStep) out of range.
BFFF0804 CH1 is not ready for VXI to write.

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BFFF0805	CH2 is not ready for VXI to write.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_setSweepStart

ViStatus itsm25_setSweepStart (ViSession instrSession, ViUInt16 channel, float sweepStart);

Purpose

Description: Sets the start value of the voltage or current of the module in sweep mode.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

sweepStart

Variable Type float

Description: Sets the start value in sweep mode.

Valid Range: Dependent on source mode:

Voltage Source: -25V to 25V

Current Source: -1A to 1A

Default Value: 0

Return Value

Reports the status of itsm25_setSweepStart.

———————————————————————————————-

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.
BFFC0003 Parameter 3 (sweepStart) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_setSweepStop

ViStatus itsm25_setSweepStop (ViSession instrSession, ViUInt16 channel float sweepStop);

Purpose

Description: Sets the stop value of the voltage or current of the module in sweep mode.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

sweepStop

Variable Type float

Description: Sets the stop value in sweep mode.

Valid Range: Dependent on source mode:

Voltage Source: -25V to 25V

Current Source: -1A to 1A

Default Value: 0

Return Value

Reports the status of itsm25_setSweepStop.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.
BFFC0003 Parameter 3 (sweepStop) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_setToffTime

ViStatus itsm25_setToffTime (ViSession instrSession, ViUInt16 channel, ViUInt16 toff);

Purpose

Description: Sets the Toff time (count in ms, range from 0 ~ 65535 ms).

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

toff

Variable Type ViUInt16

Description: Sets the Toff time in ms.

Valid Range: 0 ~ 65535 ms

Default Value: 0

Return Value

Reports the status of itsm25_setToffTime.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.
BFFC0003 Parameter 3 (toff) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_setTonTime

ViStatus itsm25_setTonTime (ViSession instrSession, ViUInt16 channel, ViUInt16 ton);

Purpose

Description: Sets the Ton time (count in ms, range from 0 ~ 65535 ms).

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

ton

Variable Type ViUInt16

Description: Sets the Ton time in ms.

Valid Range: 0 ~ 65535 ms

Default Value: 0

Return Value

Reports the status of itsm25_setTonTime.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFC0003	Parameter 3 (ton) out of range.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_setTriggerLevel

ViStatus itsm25_setTriggerLevel (ViSession instrSession, ViUInt16 trigLevel);

Purpose

Description: This function sets the voltage level of the trigger output lines for the module.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

trigLevel

Variable Type ViUInt16

Description: Sets the voltage level of the trigger output lines.

Valid Range: 0 - Low pulse

1 - High pulse

Default Value: 0 - Low pulse

Return Value

Reports the status of itsm25_setTriggerLevel.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (trigLevel) out of range.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_setUpperLimit

ViStatus itsm25_setUpperLimit (ViSession instrSession, ViUInt16 channel, float upperLimit);

Purpose

Description: This function sets the upper limit of the Window Comparator.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

upperLimit

Variable Type float

Description: Sets the upper limit of the Window Comparator.

Valid Range: Dependent on source mode:

Current Source: -1A to 1A

Voltage Source: -25V to 25V

Default Value: 0.0

Return Value

Reports the status of itsm25_setUpperLimit.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.
BFFC0003 Parameter 3 (upperLimit) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_setValidRecord

ViStatus itsm25_setValidRecord (ViSession instrSession, ViUInt16 channel, ViUInt16 validRecord);

Purpose

Description: Sets the number of the valid Records in the Append mode.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

validRecord

Variable Type ViUInt16

Description: Sets the number of valid Records in FIFO. (Append Mode)

Valid Range: 1 to 255

Default Value: 1

Return Value

Reports the status of itsm25_setValidRecord.

---

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.
BFFC0003 Parameter 3 (validRecord) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF005 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_setVoltageCompliance

ViStatus itsm25_setVoltageCompliance (ViSession instrSession, ViUInt16 channel, float compliance);

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1

2 - Channel 2

Default Value: 1 - Channel 1

compliance

Variable Type float

Description: Sets the measurement compliance in volts. The value should be between 2% ~ 100% of a specified voltage range.

Valid Range: 0.01 to 25.0 V

Default Value: 25.0

Return Value

Reports the status of itsm25_setVoltageCompliance.

0 No error (the call was successful).

BFFC0002 Parameter 2 (channel) out of range.
BFFC0003 Parameter 3 (compliance) out of range.
BFFF0804 CH1 is not ready for VXI to write.
BFFF0805 CH2 is not ready for VXI to write.
BFFF000E The given session reference is invalid.
BFFF000F Resource locked for the specified access.
BFFF0038 Bus error occurred during transfer.
BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E Invalid address specified.
BFFF0051 Invalid offset specified.
BFFF0054 Specified offset is not accessible from this hardware.
BFFF0067 Operation is not supported on this session.
BFFF0070 The specified offset is not properly aligned for the access width of the operation.
BFFF0076 Specified width is not supported by this hardware.

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itsm25_setWorkModeFunction

ViStatus itsm25_setWorkModeFunction (ViSession instrSession, ViUInt16 channel,
ViUInt16 function, ViUInt16 block,
ViUInt16 shape, ViUInt16 mode);

Purpose

Description: This function sets the work mode and the function type.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

channel

Variable Type ViUInt16

Description: Selects channel of the instrument to be controlled.

Valid Range: 1 - Channel 1
2 - Channel 2

Default Value: 1 - Channel 1

function

Variable Type ViUInt16

Description: Sets the instrument to be either "Force V, Measure I" or "Force I, Measure V" function.

Valid Range: 0 - Force V, Measure I
1 - Force I, Measure V

Default Value: 0 - Force V, Measure I

block

Variable Type ViUInt16

Description: Sets the block mode of the instrument.

Valid Range: 0 - Off
1 - On

Default Value: 0 - Off

shape

Variable Type ViUInt16

Description: Sets the output shape of the instrument.

Valid Range: 0 - Continuous
1 - Pulse

Default Value: 0 - Continuous

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mode

Variable Type	ViUInt16
Description:	Selects the output function mode of the instrument.
Valid Range:	0 - DC
	1 - Fixed
	2 – Sweep (Linear)
	3 – Sweep (Log)
	4 - Append
Default Value:	0 - DC

Return Value

Reports the status of itsm25_setWorkModeFunction.

0	No error (the call was successful).
BFFC0002	Parameter 2 (channel) out of range.
BFFC0003	Parameter 3 (function) out of range.
BFFC0004	Parameter 4 (block) out of range.
BFFC0005	Parameter 5 (shape) out of range.
BFFC0006	Parameter 6 (mode) out of range.
BFFF0804	CH1 is not ready for VXI to write.
BFFF0805	CH2 is not ready for VXI to write.
BFFF0813	DC is not valid in fixed shape.
BFFF000E	The given session reference is invalid.
BFFF000F	Resource locked for the specified access.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).
BFFF004E	Invalid address specified.
BFFF0051	Invalid offset specified.
BFFF0054	Specified offset is not accessible from this hardware.
BFFF0067	Operation is not supported on this session.
BFFF0070	The specified offset is not properly aligned for the access width of the operation.
BFFF0076	Specified width is not supported by this hardware.

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itsm25_timeOut

ViStatus itsm25_timeOut (ViSession instrSession, ViInt32 timeOut);

Purpose

Description The timeout function sets a minimum timeout value for driver I/O transactions in milliseconds. The timeout period may vary on computer platforms. The default timeout period is 5 seconds.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

timeOut

Variable Type ViInt32

This value sets the I/O timeout for all functions in the driver. It is specified in milliseconds. The allowable range of values is shown below as macros.

Valid Range: 0 to 2147483647

Default Value: 5000

Return Value

Reports the status of itsm25_timeOut.

———————————————————————————————————-

0 No error (the call was successful).

3FFF0084 Although the specified attribute state is valid, it is not supported by this implementation.

BFFF000E The given object reference is invalid.

BFFF001D The specified attribute is not defined by the referenced object.

BFFF001E The specified state of the attribute is not valid, or is not supported as defined by the object.

BFFF001F The specified attribute is read-only.

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itsm25_timeOutQuery

ViStatus itsm25_timeOutQuery (ViSession instrSession, ViInt32 *timeOut);

Purpose

The timeout query function returns the timeout value for driver I/O transactions in milliseconds. The timeout period may vary on computer platforms.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

timeOut

Variable Type ViInt32 (passed by reference)

This is the minimum timeout period that the driver can be set to. It is specified in milliseconds.

Return Value

Reports the status of itsm25_timeoutQuery.

———————————————————————————————-

0 No error (the call was successful).

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).

BFFF004E Invalid address specified.

BFFF0051 Invalid offset specified.

BFFF0054 Specified offset is not accessible from this hardware.

BFFF0067 Operation is not supported on this session.

BFFF0070 The specified offset is not properly aligned for the access width of the operation.

BFFF0076 Specified width is not supported by this hardware.

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itsm25_writeInst

ViStatus itsm25_writeInst (ViSession instrSession, ViInt16 reg, ViUInt16 value);

Purpose

This function writes Operation Code or related parameters to the instrument register to modify device settings.

Parameter List

instrSession

Variable Type ViSession

Description: Accepts the Instrument Handle returned by the Initialize function to select the desired instrument driver session.

reg

Variable Type ViInt16

This input determines which register is written to.

Valid Range: 0x00 ~ 0x1A

Default Value: 0x00

value

Variable Type ViUInt16

This control writes data (in hex) to a register.

Valid Range: 0x0000 - 0xFFFF

Default Value: 0x0000

Return Value

Reports the status of itsm25_writeInst.

———————————————————————————————-

0 No error (the call was successful).

BFFF000E The given session reference is invalid.

BFFF000F Resource locked for the specified access.

BFFF0038 Bus error occurred during transfer.

BFFF003A Unable to start operation because setup is invalid (due to attributes being set to an inconsistent state).

BFFF004E Invalid address specified.

BFFF0051 Invalid offset specified.

BFFF0054 Specified offset is not accessible from this hardware.

BFFF0067 Operation is not supported on this session.

BFFF0070 The specified offset is not properly aligned for the access width of the operation.

BFFF0076 Specified width is not supported by this hardware.

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Chapter 4
Programming Examples

4.1 Introduction

In this chapter, we will demonstrate some of the functions of the SM25 by programming the module and calling upon the SM25 VISA Plug&Play Driver for those function calls. The following examples are included:

- **FVMI (Source Voltage / Measure I) ...** Force voltage and measure the voltage and current readings. Calculate the total time to make the complete measurement.
- **FIMV (Source I / Measure Voltage) ...** Force current and measure the voltage and current readings. Calculate the total time to make the complete measurement.
- **Sweep ...** Sweep function sets the instrument to sweep a linear voltage.
- **Block** ... Block function demonstrates how to use "Block" mode for data output.

The C language example programs were developed using the following system configuration:

- **Mainframe:** HP 75000 Series C (HP E1401A)
- **Controller**: Intel Pentium-800MHz CPU / Microsoft Windows 98 with National Instrument MXI.
- **Development Environment:** National Instrument LabWindows/CVI v5.0

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4.2 Force Voltage / Measure I (FVMI)

This example will force a voltage and measure the voltage and current readings and also calculate the total time to make the complete measurement.

```
#include "Itsm25.h"                    /* include the driver header file */
#include <utility.h>
#include <formatio.h>
#include <ansi_c.h>
#include <userint.h>

static ViStatus errStatus;
static ViSession vi;
ViChar err_message[256];
static float amp1Fifo;
static float volt1Fifo;
static float amp2Fifo;
static float volt2Fifo;
double beginTime, start1Time, start2Time, end1Time, end2Time;
unsigned short stat_reg;

#define INSTR_ADDRESS "VXI0::3::INSTR"      //VXI addressing
#define workChannel 2                              //Set Ch2 as the operational channel
#define regStatusCntl     0x4                      //Status register for SM25

/* prototypes */
void check (ViSession vi, ViStatus errStatus);
void checkOperating (void);

void main(void)
{

        Cls();

        beginTime = Timer();

  /*
   * First we must call itsm25_init to get the device
   * session. We can reset the module if necessary.
   */
        errStatus = itsm25_init (INSTR_ADDRESS, VI_ON, VI_ON, &vi);
        if( VI_SUCCESS > errStatus)
        {
           Fmt(err_message,"%s<Unable to open ITSM25 at %s",INSTR_ADDRESS);
                MessagePopup ("ITSM25", err_message);
                return;
        }

  /*
```


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```
 * Configure function mode and related parameters.
       * For detail description, you can right click on the
       * function call to get help from the function panel.
*/

      /* Set function as Source V, Measure I, generate a fixed pulse */
      errStatus = itsm25_setWorkModeFunction (vi, workChannel, 0, 0, 0, 1);
      check(vi, errStatus);

      /* Set V range as 25V, I range as 100 mA and enable output */
      errStatus = itsm25_setSourceRangeRelay (vi, workChannel, 2, 5, 0, 1,
                                                                  1, 0, 0, 1);
      check(vi, errStatus);

      /* Set Integral Rate as fast */
      errStatus = itsm25_setIntegralRate (vi, workChannel, 0);
      check(vi, errStatus);

      /* Set current compliance as 100 mA */
      errStatus = itsm25_setCurrentCompliance (vi, workChannel, 0.1);
      check(vi, errStatus);

      /* Set Ton time to 0 mS */
      errStatus = itsm25_setTonTime (vi, workChannel, 0);
      check(vi, errStatus);

      /* Set Toff time to 0 mS */
      errStatus = itsm25_setToffTime (vi, workChannel, 0);
      check(vi, errStatus);

      /* Set the number of measurement readings to 1 */
      errStatus = itsm25_setMeasureReading (vi, workChannel, 1);
      check(vi, errStatus);

      /* Set the number of average per readings to 1 */
      errStatus = itsm25_setAverage (vi, workChannel, 1);
      check(vi, errStatus);

      /* Set the bias function off */
      errStatus = itsm25_setBiasFunction (vi, workChannel, 0);
      check(vi, errStatus);

      /* Set voltage output as 10.0 V */
      errStatus = itsm25_setDcFixedCommand (vi, workChannel, 10.0);
      check(vi, errStatus);

/*
 * Start operation
       */

      MessagePopup ("SM25", "SM25 is going to run, hit OK to continue.");

      start1Time = Timer();

      /* Starts all specified activities immediately. */
```


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```
        errStatus = itsm25_operationStartImm (vi, workChannel);

/*
 * Read back voltage and current values
        */

        errStatus = itsm25_readFIFOData (vi, workChannel, &volt1Fifo, &amp1Fifo);

        end1Time = Timer();

        //*********************************************************************

        /* Set voltage output as -5.0 V */
        errStatus = itsm25_setDcFixedCommand (vi, workChannel, -5.0);
        check(vi, errStatus);

        MessagePopup ("SM25", "Change voltage to -5V, hit OK to continue.");

start2Time = Timer();

        /* Starts all specified activities immediately. */
        //#1
        errStatus = itsm25_operationStartImm (vi, workChannel);
        errStatus = itsm25_readFIFOData (vi, workChannel, &volt2Fifo, &amp2Fifo);

        //#2
        checkOperating();
        errStatus = itsm25_operationStartImm (vi, workChannel);
        errStatus = itsm25_readFIFOData (vi, workChannel, &volt2Fifo, &amp2Fifo);

        //#3
        checkOperating();
        errStatus = itsm25_operationStartImm (vi, workChannel);
        errStatus = itsm25_readFIFOData (vi, workChannel, &volt2Fifo, &amp2Fifo);

        //#4
        checkOperating();
        errStatus = itsm25_operationStartImm (vi, workChannel);
        errStatus = itsm25_readFIFOData (vi, workChannel, &volt2Fifo, &amp2Fifo);

        //#5
        checkOperating();
        errStatus = itsm25_operationStartImm (vi, workChannel);
        errStatus = itsm25_readFIFOData (vi, workChannel, &volt2Fifo, &amp2Fifo);

        //#6
        checkOperating();
        errStatus = itsm25_operationStartImm (vi, workChannel);
        errStatus = itsm25_readFIFOData (vi, workChannel, &volt2Fifo, &amp2Fifo);

        //#7
        checkOperating();
        errStatus = itsm25_operationStartImm (vi, workChannel);
        errStatus = itsm25_readFIFOData (vi, workChannel, &volt2Fifo, &amp2Fifo);
```


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```
        //#8
        checkOperating();
        errStatus = itsm25_operationStartImm (vi, workChannel);
        errStatus = itsm25_readFIFOData (vi, workChannel, &volt2Fifo, &amp2Fifo);

        //#9
        checkOperating();
        errStatus = itsm25_operationStartImm (vi, workChannel);
        errStatus = itsm25_readFIFOData (vi, workChannel, &volt2Fifo, &amp2Fifo);

        //#10
        checkOperating();
        errStatus = itsm25_operationStartImm (vi, workChannel);
        errStatus = itsm25_readFIFOData (vi, workChannel, &volt2Fifo, &amp2Fifo);

        end2Time = Timer();

        //*********************************************************************

        /* display the readings */
        printf("Voltage1 in FIFO = %f V\n", volt1Fifo);
        printf("Current1 in FIFO = %f A\n", amp1Fifo);
        printf("start1Time = %f S\n", start1Time);
        printf("end1Time = %f S\n", end1Time);
        printf("Diff: %f\n",end1Time - start1Time);

        printf("\n");
        printf("Voltage2 in FIFO = %f V\n", volt2Fifo);
        printf("Current2 in FIFO = %f A\n", amp2Fifo);
        printf("start2Time = %f S\n", start2Time);
        printf("end2Time = %f S\n", end2Time);
        printf("Diff: %f\n",(end2Time - start2Time)/10);

        printf("\n");

  /*
    * Close VISA session
        */

        /* close the device session */
        errStatus = itsm25_close(vi);

}

/* error checking routine */
void check (ViSession vi, ViStatus errStatus)
{
        ViStatus TempCheck;
        ViChar ErrMsg[256];

        if(VI_SUCCESS != errStatus)
        {
           TempCheck = itsm25_error_message(vi, errStatus, ErrMsg);
           Fmt(err_message,"%s<Error in ITSM25: %x\nDescription: %s",errStatus,ErrMsg);
                //MessagePopup ("ITSM25", err_message);
```


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```
                printf("%s\n", err_message);
                itsm25_reset(vi);
                itsm25_close(vi);
                exit(1);
        }
        return;
}

// Check if the module is operating
void checkOperating (void)
{
        errStatus = itsm25_readInst (vi, regStatusCntl, &stat_reg);

   if (workChannel == 1) {
                while ((stat_reg & 0x2000) == 0x2000)
                {
                        errStatus = itsm25_readInst (vi, regStatusCntl, &stat_reg);
                        //check(vi, errStatus);
                }
        }
        else {
                while ((stat_reg & 0x0100) == 0x0100)
                {
                        errStatus = itsm25_readInst (vi, regStatusCntl, &stat_reg);
                        //check(vi, errStatus);
                }
        }
}
```


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4.3 Force I / Measure Voltage (FIMV)

This example is similar to the first example except that we now will force current and measure the voltage and current readings. This example also calculates the total time to make the complete measurement.

```
#include "Itsm25.h"                    /* include the driver header file */
#include <utility.h>
#include <formatio.h>
#include <ansi_c.h>
#include <userint.h>

static ViStatus errStatus;
static ViSession vi;
ViChar err_message[256];
float volt;
float amp;
double beginTime, end1Time, end2Time;

#define INSTR_ADDRESS "VXI0::3::INSTR"          //VXI addressing
#define workChannel 2                           //Set Ch2 as the operational channel

/* prototypes */
void check (ViSession vi, ViStatus errStatus);

void main(void)
{

        Cls();

  /*
   * First we must call itsm25_init to get the device
   * session. We can reset the module if necessary.
   */
        errStatus = itsm25_init (INSTR_ADDRESS, VI_ON, VI_ON, &vi);
        if( VI_SUCCESS > errStatus)
        {
           Fmt(err_message,"%s<Unable to open ITSM25 at %s",INSTR_ADDRESS);
                MessagePopup ("ITSM25", err_message);
                return;
        }

  /*
   * Configure function mode and related parameters.
         * For detail description, you can right click on the
         * function call to get help from the function panel.
   */

        /* Set function as Source I, Measure V, mode as Fixed */
```


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```
        errStatus = itsm25_setWorkModeFunction (vi, workChannel, 1, 0, 1, 1);
        check(vi, errStatus);

        /* Set V range as 25V, I range 10 mA, and enable output */
        errStatus = itsm25_setSourceRangeRelay (vi, workChannel, 2, 4, 0, 1,
                                                                        1, 1, 0, 1);
        check(vi, errStatus);

        /* Set Integral Rate as fast */
        errStatus = itsm25_setIntegralRate (vi, workChannel, 0);
        check(vi, errStatus);

        /* Set current output as 5 mA */
        errStatus = itsm25_setDcFixedCommand (vi, workChannel, 0.005);
        check(vi, errStatus);

        /* Set voltage compliance as 20.0 V */
        errStatus = itsm25_setVoltageCompliance (vi, workChannel, 20.0);
        check(vi, errStatus);

        /* Set Ton time to 5 mS */
        errStatus = itsm25_setTonTime (vi, workChannel, 5);
        check(vi, errStatus);

        /* Set Toff time to 5 mS */
        errStatus = itsm25_setToffTime (vi, workChannel, 5);
        check(vi, errStatus);

        /* Set the number of measurement readings to 1 */
        errStatus = itsm25_setMeasureReading (vi, workChannel, 1);
        check(vi, errStatus);

        /* Set the number of average per readings to 1 */
        errStatus = itsm25_setAverage (vi, workChannel, 1);
        check(vi, errStatus);

        /* Set the bias function off */
        errStatus = itsm25_setBiasFunction (vi, workChannel, 0);
        check(vi, errStatus);

    /*
     * Start operation
           */

        MessagePopup ("SM25", "SM25 is going to run, hit OK to continue.");

        beginTime = Timer();

        /* Starts all specified activities immediately. */
        errStatus = itsm25_operationStartImm (vi, workChannel);
        check(vi, errStatus);
```


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```
  /*
   * Read back voltage and current values
         */

        /* Gets the reading of the voltage in volts. */
        errStatus = itsm25_readVoltage (vi, workChannel, &volt);
        end1Time = Timer();
        check(vi, errStatus);

        /* Gets the reading of the current in amps. */
        errStatus = itsm25_readCurrent (vi, workChannel, &amp);
        end2Time = Timer();
        check(vi, errStatus);

        /* display the readings */
        printf("Voltage = %f V\n", volt);
        printf("Current = %f A\n", amp);

        printf("beginTime = %f S\n", beginTime);
        printf("end1Time = %f S\n", end1Time);
        printf("end2Time = %f S\n", end2Time);

  /*
   * Stop operation
         */

        /* Stops all running activities and to standby mode. */
        //errStatus = itsm25_operationStop (vi, workChannel);
        //check(vi, errStatus);

  /*
   * Close VISA session
         */

        /* close the device session */
        errStatus = itsm25_close(vi);

}

/* error checking routine */
void check (ViSession vi, ViStatus errStatus)
{
        if(VI_SUCCESS != errStatus)
        {
           Fmt(err_message,"%s<Error in ITSM25, Error Code : %x",errStatus);
                MessagePopup ("ITSM25", err_message);
                itsm25_reset(vi);
                itsm25_close(vi);
                exit(1);
        }
        return;
```


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4.4 Sweep

This example will demonstrate the use of a "Sweep" function by sweeping a linear voltage between a set number of steps.

```
#include "Itsm25.h"                    /* include the driver header file */
#include <utility.h>
#include <formatio.h>
#include <ansi_c.h>
#include <userint.h>

static ViStatus errStatus;
static ViSession vi;
ViChar err_message[256];
static float volt1Fifo, amp1Fifo;
static float volt2Fifo, amp2Fifo;
static float volt3Fifo, amp3Fifo;
static float volt4Fifo, amp4Fifo;
static float volt5Fifo, amp5Fifo;
static float volt6Fifo, amp6Fifo;
static float volt7Fifo, amp7Fifo;
static float volt8Fifo, amp8Fifo;
static float volt9Fifo, amp9Fifo;
static float volt10Fifo, amp10Fifo;
static float volt11Fifo, amp11Fifo;
double beginTime, endTime;

#define INSTR_ADDRESS "VXI0::3::INSTR"          //VXI addressing
#define workChannel 2                           //Set Ch2 as the operational channel

/* prototypes */
void check (ViSession vi, ViStatus errStatus);

void main(void)
{

        Cls();

  /*
   * First we must call itsm25_init to get the device
   * session. We can reset the module if necessary.
   */
        errStatus = itsm25_init (INSTR_ADDRESS, VI_ON, VI_ON, &vi);
        if( VI_SUCCESS > errStatus)
        {
           Fmt(err_message,"%s<Unable to open ITSM25 at %s",INSTR_ADDRESS);
                MessagePopup ("ITSM25", err_message);
                return;
        }

  /*
   * Configure function mode and related parameters.
         * For detail description, you can right click on the
         * function call to get help from the function panel.
```


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```
 */

        /* Set function as Source V, Measure I, operate in sweep mode */
        errStatus = itsm25_setWorkModeFunction (vi, workChannel, 0, 0, 1, 2);
        check(vi, errStatus);

        /* Set V range as 5 V, I range as 100 mA, and enable output */
        errStatus = itsm25_setSourceRangeRelay (vi, workChannel, 1, 5, 0, 1,
                                                                        1, 1, 0, 1);
        check(vi, errStatus);

        /* Set Integral Rate as fast */
        errStatus = itsm25_setIntegralRate (vi, workChannel, 0);
        check(vi, errStatus);

        /* Set current compliance as 100 mA */
        errStatus = itsm25_setCurrentCompliance (vi, workChannel, 0.1);
        check(vi, errStatus);

        /* Set Ton time to 5 mS */
        errStatus = itsm25_setTonTime (vi, workChannel, 5);
        check(vi, errStatus);

        /* Set Toff time to 5 mS */
        errStatus = itsm25_setToffTime (vi, workChannel, 5);
        check(vi, errStatus);

        /* Set the number of measurement readings to 1 */
        errStatus = itsm25_setMeasureReading (vi, workChannel, 1);
        check(vi, errStatus);

        /* Set the number of average per readings to 1 */
        errStatus = itsm25_setAverage (vi, workChannel, 1);
        check(vi, errStatus);

        /* Set the bias function off */
        errStatus = itsm25_setBiasFunction (vi, workChannel, 0);
        check(vi, errStatus);

        /* Set the linear step value to 11 */
        errStatus = itsm25_setSweepLogLinStep (vi, workChannel, 0, 11);
        check(vi, errStatus);

        /* Set the start value of the sweep to -5 V */
        errStatus = itsm25_setSweepStart (vi, workChannel, -5);
        check(vi, errStatus);

        /* Set the stop value of the sweep to 5 V */
        errStatus = itsm25_setSweepStop (vi, workChannel, 5);
        check(vi, errStatus);

/*
 * Start operation
        */
```


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```
        MessagePopup ("SM25", "SM25 is going to run, hit OK to continue.");

        beginTime = Timer();

        /* Starts all specified activities immediately. */
        errStatus = itsm25_operationStartImm (vi, workChannel);
        check(vi, errStatus);

/*
  * Read back voltage values from FIFO
        */

        /* Gets the reading of the voltage in volts. */
        errStatus = itsm25_readFIFOData (vi, workChannel, &volt1Fifo, &amp1Fifo);
        check(vi, errStatus);

        errStatus = itsm25_readFIFOData (vi, workChannel, &volt2Fifo, &amp2Fifo);
        check(vi, errStatus);

        errStatus = itsm25_readFIFOData (vi, workChannel, &volt3Fifo, &amp3Fifo);
        check(vi, errStatus);

        errStatus = itsm25_readFIFOData (vi, workChannel, &volt4Fifo, &amp4Fifo);
        check(vi, errStatus);

        errStatus = itsm25_readFIFOData (vi, workChannel, &volt5Fifo, &amp5Fifo);
        check(vi, errStatus);

        errStatus = itsm25_readFIFOData (vi, workChannel, &volt6Fifo, &amp6Fifo);
        check(vi, errStatus);

        errStatus = itsm25_readFIFOData (vi, workChannel, &volt7Fifo, &amp7Fifo);
        check(vi, errStatus);

        errStatus = itsm25_readFIFOData (vi, workChannel, &volt8Fifo, &amp8Fifo);
        check(vi, errStatus);

        errStatus = itsm25_readFIFOData (vi, workChannel, &volt9Fifo, &amp9Fifo);
        check(vi, errStatus);

        errStatus = itsm25_readFIFOData (vi, workChannel, &volt10Fifo, &amp10Fifo);
        check(vi, errStatus);

        errStatus = itsm25_readFIFOData (vi, workChannel, &volt11Fifo, &amp11Fifo);
        check(vi, errStatus);

        endTime = Timer();

        /* display the readings */
        printf("FIFO #1  Voltage = %f V, Current = %f A\n", volt1Fifo, amp1Fifo);
        printf("FIFO #2  Voltage = %f V, Current = %f A\n", volt2Fifo, amp2Fifo);
        printf("FIFO #3  Voltage = %f V, Current = %f A\n", volt3Fifo, amp3Fifo);
        printf("FIFO #4  Voltage = %f V, Current = %f A\n", volt4Fifo, amp4Fifo);
        printf("FIFO #5  Voltage = %f V, Current = %f A\n", volt5Fifo, amp5Fifo);
        printf("FIFO #6  Voltage = %f V, Current = %f A\n", volt6Fifo, amp6Fifo);
```


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```
        printf("FIFO #7 Voltage = %f V, Current = %f A\n", volt7Fifo, amp7Fifo);
        printf("FIFO #8 Voltage = %f V, Current = %f A\n", volt8Fifo, amp8Fifo);
        printf("FIFO #9 Voltage = %f V, Current = %f A\n", volt9Fifo, amp9Fifo);
        printf("FIFO #10 Voltage = %f V, Current = %f A\n", volt10Fifo, amp10Fifo);
        printf("FIFO #11 Voltage = %f V, Current = %f A\n", volt11Fifo, amp11Fifo);
        printf("Start Time = %f S\n", beginTime);
        printf("End Time = %f S\n", endTime);

  /*
   * Stop operation
        */

        /* Stops all running activities and to standby mode. */
        //errStatus = itsm25_operationStop (vi, workChannel);
        //check(vi, errStatus);


  /*
   * Close VISA session
        */

        /* close the device session */
        errStatus = itsm25_close(vi);

}

/* error checking routine */
void check (ViSession vi, ViStatus errStatus)
{

        if(VI_SUCCESS != errStatus)
        {
           Fmt(err_message,"%s<Error in ITSM25, Error Code : %x",errStatus);
                MessagePopup ("ITSM25", err_message);
                itsm25_reset(vi);
                itsm25_close(vi);
                exit(1);
        }
        return;
}
```


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4.5 Block

This example demonstrates the instrument's ability to transfer data in "Block" mode.

```
#include "Itsm25.h"                    /* include the driver header file */
#include <utility.h>
#include <formatio.h>
#include <ansi_c.h>
#include <userint.h>

static ViStatus errStatus;
static ViSession vi;
ViChar err_message[256];
static ViUInt16 data[512];
static float current[70];
static float voltage[70];
int i;
union dspFloat {
          float f;
                    ViUInt16 w[2];
                   } fifoData;


#define INSTR_ADDRESS "VXI0::3::INSTR"              //VXI addressing
#define workChannel 2                          //Set Ch2 as the operational channel

/* prototypes */
void check (ViSession vi, ViStatus errStatus);

void main(void)
{

        Cls();

  /*
   * First we must call itsm25_init to get the device
   * session. We can reset the module if necessary.
   */
        errStatus = itsm25_init (INSTR_ADDRESS, VI_ON, VI_ON, &vi);
        if( VI_SUCCESS > errStatus)
        {
           Fmt(err_message,"%s<Unable to open ITSM25 at %s",INSTR_ADDRESS);
                MessagePopup ("ITSM25", err_message);
                return;
        }

  /*
   * Configure function mode and related parameters.
         * For detail description, you can right click on the
         * function call to get help from the function panel.
   */
```


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```
        errStatus = itsm25_reset (vi);
        check(vi, errStatus);

        /* Set function as Source V, Measure I, shape as Pulse, mode as Fixed */
        errStatus = itsm25_setWorkModeFunction (vi, workChannel, 0, 1, 1, 1);
        check(vi, errStatus);

        /* Set V range 5V, I range 100mA, and enable output */
        errStatus = itsm25_setSourceRangeRelay (vi, workChannel, 1, 5, 0, 1,
                                                                        1, 1, 0, 1);
        check(vi, errStatus);

        /* Set Integral Rate as fast */
        errStatus = itsm25_setIntegralRate (vi, workChannel, 0);
        check(vi, errStatus);

        /* Set current compliance as 100 mA */
        errStatus = itsm25_setCurrentCompliance (vi, workChannel, 0.1);
        check(vi, errStatus);

        /* Set Ton time to 0 mS */
        errStatus = itsm25_setTonTime (vi, workChannel, 0);
        check(vi, errStatus);

        /* Set Toff time to 0 mS */
        errStatus = itsm25_setToffTime (vi, workChannel, 0);
        check(vi, errStatus);

        /* Set the number of measurement readings to 64 */
        errStatus = itsm25_setMeasureReading (vi, workChannel, 64);
        check(vi, errStatus);

        /* Set the number of average per readings to 1 */
        errStatus = itsm25_setAverage (vi, workChannel, 1);
        check(vi, errStatus);

        /* Set the bias function off */
        errStatus = itsm25_setBiasFunction (vi, workChannel, 0);
        check(vi, errStatus);

        /* Set voltage output as 4.5 V */
        errStatus = itsm25_setDcFixedCommand (vi, workChannel, 4.5);
        check(vi, errStatus);

    /*
     * Start operation
          */

        MessagePopup ("SM25", "SM25 is going to run, hit OK to continue.");

        /* Starts all specified activities immediately. */
        errStatus = itsm25_operationStartImm (vi, workChannel);
        check(vi, errStatus);
```


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```
        Delay(1);

  /*
    * Read back voltage and current values from FIFO
        */

        errStatus = itsm25_readFIFOBlock (vi, workChannel, 64, voltage,
                                                                current);
        check(vi, errStatus);

        for (i=0;i<63;i++)
        {
                printf("voltage #%d value = %f\n", i, voltage[1]);
                printf("current #%d value = %f\n", i, current[i]);
        }

    //Stop operation

        /* Stops all running activities and to standby mode. */
        errStatus = itsm25_operationStop (vi, workChannel);
        check(vi, errStatus);

  /*
    * Close VISA session
        */

        /* close the device session */
        errStatus = itsm25_close(vi);

}

/* error checking routine */
void check (ViSession vi, ViStatus errStatus)
{

        if(VI_SUCCESS != errStatus)
        {
           Fmt(err_message,"%s<Error in ITSM25, Error Code : %x",errStatus);
                MessagePopup ("ITSM25", err_message);
                itsm25_reset(vi);
                itsm25_close(vi);
                exit(1);
        }
        return;
}
```


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Chapter 5
Calibration

5.1 Introduction

Calibration of the SM25 is performed over the VXIbus. This chapter contains the recommended calibration equipment, environmental conditions, warm-up period and the step-by-step self-calibration procedures. If any of the calibration steps cannot be performed without error, contact the factory.

Ideally the DSP processor can interpret the value directly from the command string in the registers to the D/A converter to obtain the analog signal it needs. In the practical sense, however, most of the components on the board are not "ideal"… that is, they have certain value tolerances, gain variations, and temperature characteristics. Hence, the DSP cannot obtain the precise value it needs even if it is designed with feedback control. In addition, the sense circuit will also have some error signal due to the bit error characteristics of the A/D converter. Therefore periodic calibration must be performed to eliminate the error effects of these components to obtain optimum instrument performance.

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5.2 Required Test Equipment

The recommended equipment for calibrating the SM25 is listed in Table 5-1. To properly calibrate the voltage ranges of the SM25, the test equipment used to measure voltage (no current source) should have an accuracy of better than 20 µV. Likewise, to properly calibrate the current ranges, the test equipment used to measure current (no voltage source) should have an accuracy of better than 50 pA.

Table 5-1. Required Calibration Test Equipment.

Manufacturer	Model	Description	Specification
Keithley	6517A	Electrometer/High Resistance Meter	20 pA ranges: ± (0.1% + 5 counts) 200 pA ranges: ± (0.1% + 1 count) 2 nA ranges: ± (0.1%+2 counts) 20 nA ranges: ± (0.03% + 1 count) 200 nA ranges: ± (0.03% + 1 count)
Interface Technology	CTF-1000	Test Fixture	High accuracy, low noise, shielded enclosure
		3k ohm resistor	±1%, ± 25 ppm/degree C
		1k ohm resistor	±1%, ± 25 ppm/degree C
Fluke	8842A	Digital Multimeter	DC Voltage Range 200 mV 2 V 20 V 200 V DC Current Range 2000 mA

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5.2.1 Environmental Conditions

Calibration should be performed under laboratory conditions having an ambient temperature of 23 ± 1.5 degrees C and a relative humidity of less than 70%.

5.2.2 Warm-Up Period

Before performing the calibration procedures, turn on the SM25 and allow it to warm up for at least one hour.

5.2.3 Calibration Period

Calibration should be performed every 12 months.

5.2.4 Wiring Diagram

The SM25 should be connected with an accurate DC Source/Measurement instrument in the following three situations:

a. Calibrating voltage D/A A/D loop is shown in Fig 5-1.

Fluke 8842A is recommended as V Measurement Instrument.

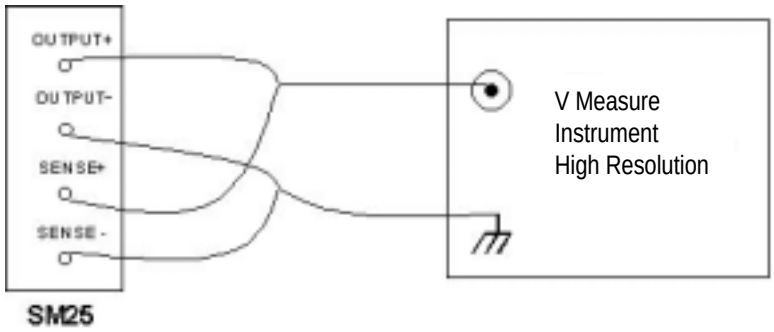

Figure 5-1.

b. Calibrating current D/A A/D loop is shown in Fig 5-2.

Keithley 6517A is recommended as I Measurement Instrument to calibrate the range of the SM25 between 1 μA and 10 mA. Fluke 8842A is recommended as I Measurement Instrument to cali brate the range between 100 mA and 1A.

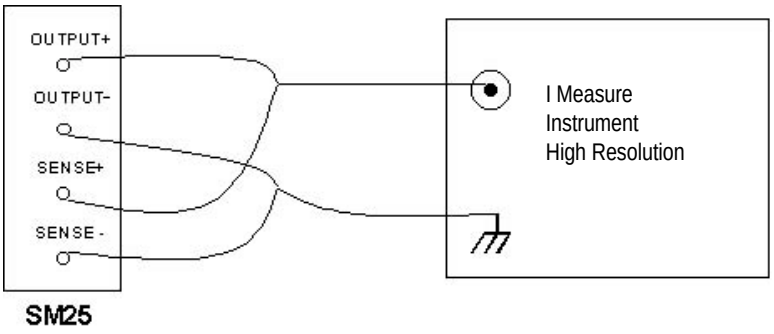

Figure 5-2.

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c. Calibrating compliance D/A for voltage loop is shown in Fig 5-3. Fluke 8842A is recommended for V Measurement Instrument.

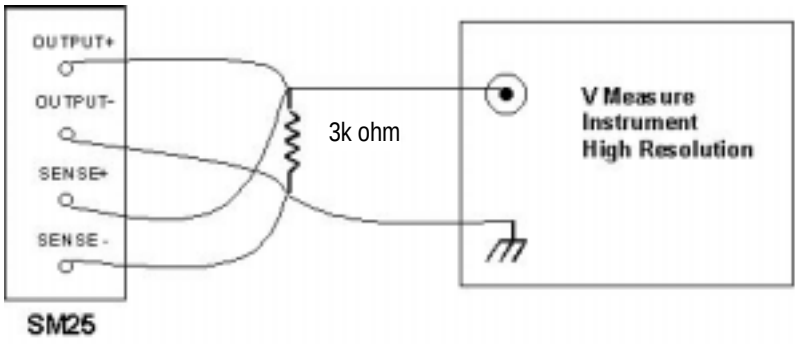

Figure 5-3.
Connection for SM25 compliance D/A Voltage Calibration

d. Calibrating compliance D/A for current loop is shown as figure 5-4. Keithley 6517A is recommended as I Measurement Instrument.

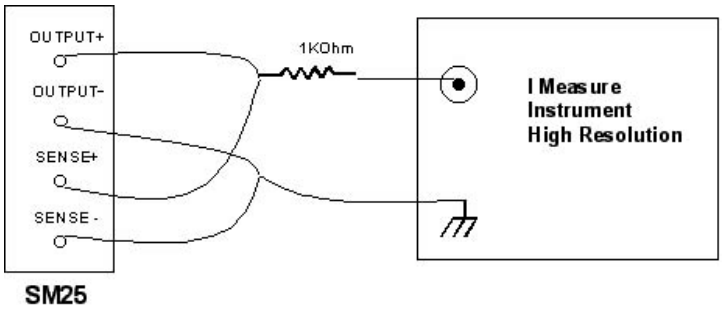

Figure 5-4.
Connection for SM25 compliance D/A I calibration

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5.3 Calibration Procedures

Before beginning calibration, make sure all of the cables, the fixture, and external measurement instruments for calibration are connected properly, then follow the on-screen instructions to calibrate. You can click the "**Cal. Ch1**" or "**Cal. Ch2**" button to calibrate SM25 channel 1 or channel 2. The "**Cal. Ch1**" and "**Cal. Ch2**" button are shown inFig 5-5.

Figure 5-5. Calibration Select Buttons.

Select differential or common mode, as shown in Fig 5-6.

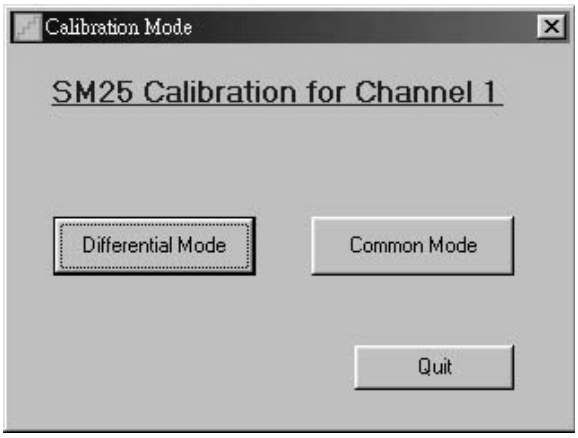

Figure 5-6. The Calibration Mode Selecting Form.

If you select **"Common Mode"** calibration, you can get the range select panel as shown in Fig 5-7. Just click the option button to calibrate the current range you want.

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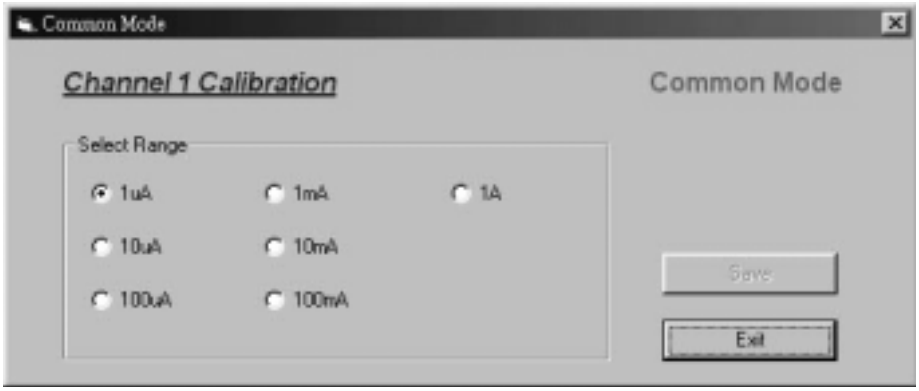

Figure 5-7. The Range Selecting Form of Calibration **.**

After you finish the calibration, the range will show in blue color as shown in Fig 5-8. Click **"Save"** button to save the results to EEPROM.

Figure 5-8. The Form of Calibrated Range.

If you select differential mode calibration, you can get the following range panel, as shown in Fig 5-9. Just click one of the 12 option buttons to select one range to calibrate.

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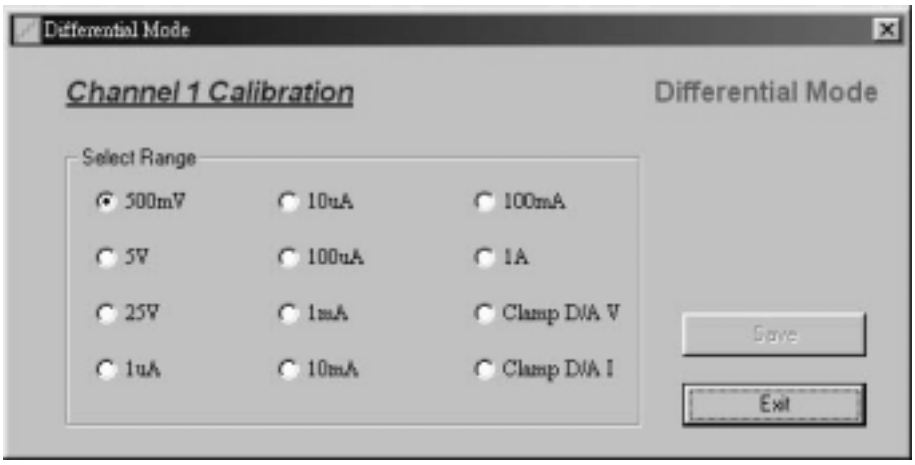

Figure 5-9. The Calibration Range Selecting Form of SM25.

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5.3.1 Calibration Steps

The following are next procedures shown on the screen to calibrate V range. They are similar to calibrate I ranges and compliance D/A loop. There are 8 steps for Voltage / Current calibration, and 3 steps for Clamp D/A calibration.

5.3.1.1 Step 1

Use the external Calibrator/Source to measure the offset value. Enter the value and then click "**OK**" button show in Fig 5-10.

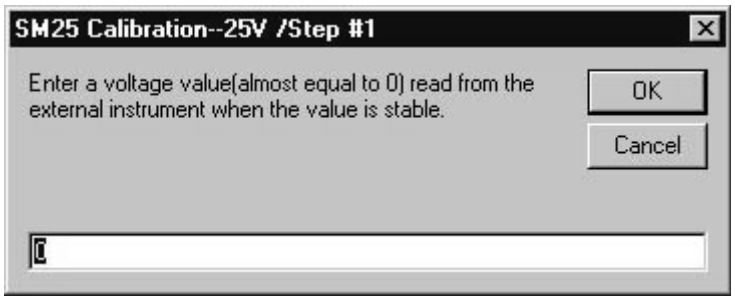
SM25 Calibration--25V /Step #1
Enter a voltage value(almost equal to 0) read from the external instrument when the value is stable.
OK
Cancel
0

Figure 5-10. Enter Offset Value.

5.3.1.2 Step 2

Use the external Calibrator/Source to measure the value corresponding to 80% full scale. Enter the value and then click "**OK**" button show in Fig 5-11.

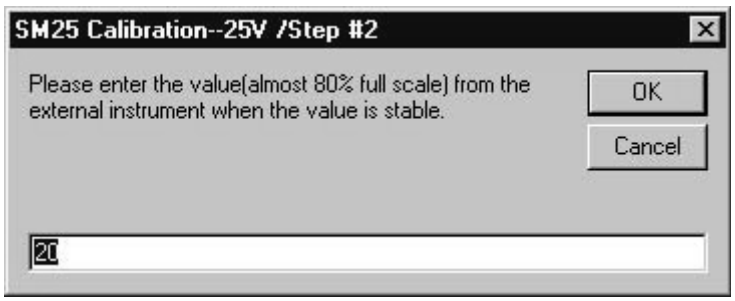
SM25 Calibration--25V /Step #2
Please enter the value(almost 80% full scale) from the external instrument when the value is stable.
OK
Cancel
20

Figure 5-11. Enter the 80% Full Scale Value.

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5.3.1.3 Step 3

Observe the offset value is less than 1 mV(for range 25V) when the system is stable. Then click "**Yes**" button if it is true or click "**No**" button if not, see Fig 5-12.

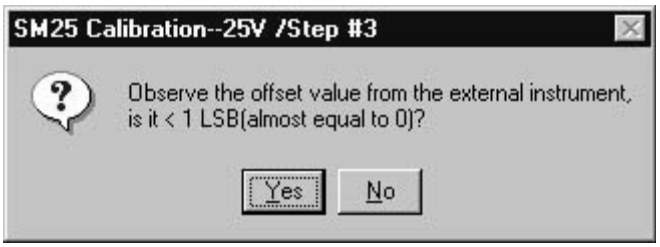

Figure 5-12. Check Offset Value.

5.3.1.4 Step 4

Make sure the observed value is close to 20V(tolerance< 1mV) when the system is stable. Then click "**Yes**" button if it is true or click "**No**" button if not. It is show as Fig 5-13.

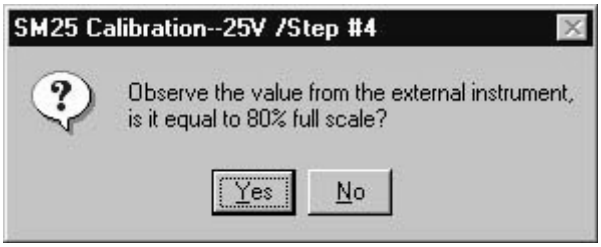

Figure 5-13. Check 80% Full Scale Value.

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5.3.1.5 Step 5

Make sure the return value is close to 0V(tolerance < 1mV) when the system is stable. Then click "**Yes**" button if it is true or click "**No**" button if not, see Fig 5-14.

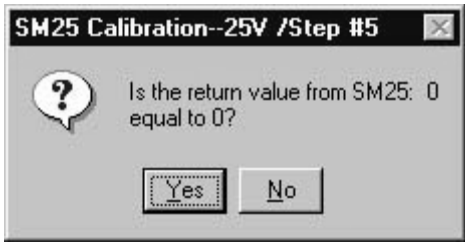

Figure 5-14. Check Return Value.

5.3.1.6 Step 6

Make sure the return value is close to 20 V(tolerance < 1mV) when the system is stable. Then click "**Yes**" button if it is true or click "**No**" button if not, see Fig 5-15.

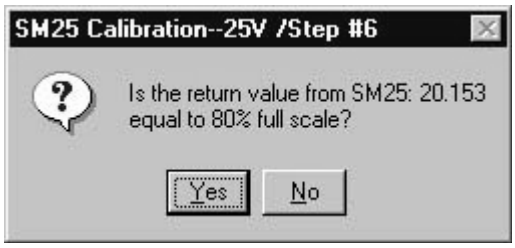

Figure 5-15. Check 80% Full Scale Return Value.

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5.3.1.7 Step7

Use the external Calibrator/Source to measure the value corresponding to -80% full scale. Enter the value and then click "**OK**" button, see Fig 5-16.

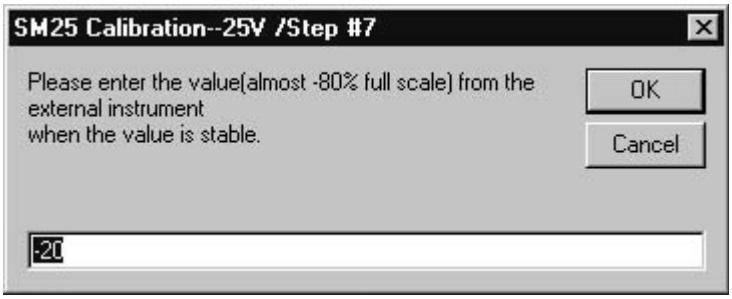

Figure 5-16. Enter Measured Value of 80% Full Scale.

5.3.1.8 Step8

Make sure the observed value is close to -20V(tolerance < 1mV) when the system is stable. Then click "**Yes**" button if it is true or click "**No**" button if not, see Fig 5-17.

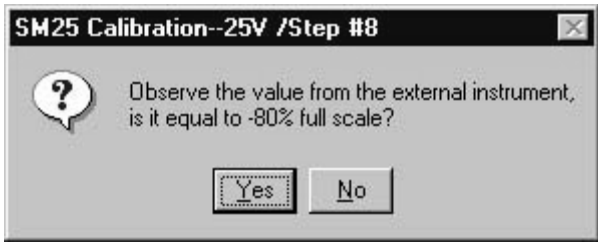

Figure 5-17. Check 80% Full Scale Return Value.

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After finishing a certain range calibration, the range text will show in blue color like figure 5-18.

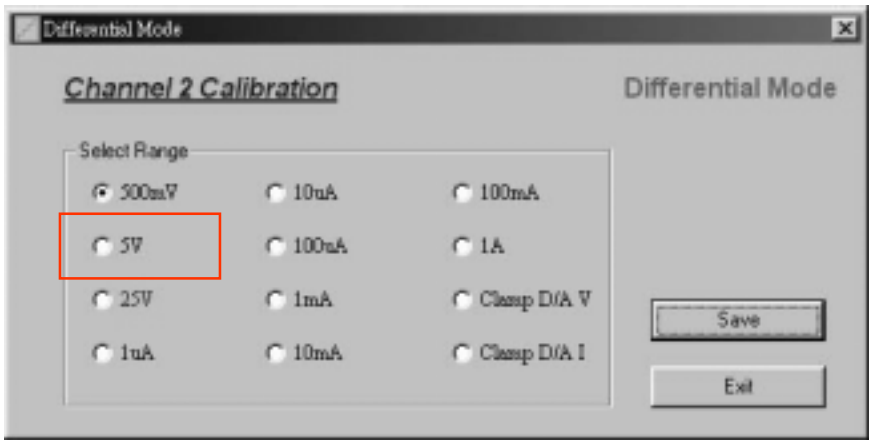

Figure 5-18. Appearance of Calibration Range Select Form After Calibration.

Then users can click "**save**" button to save the calibration results to EEPROM of SM25. The "**save**" button is shown as Fig 5-19.

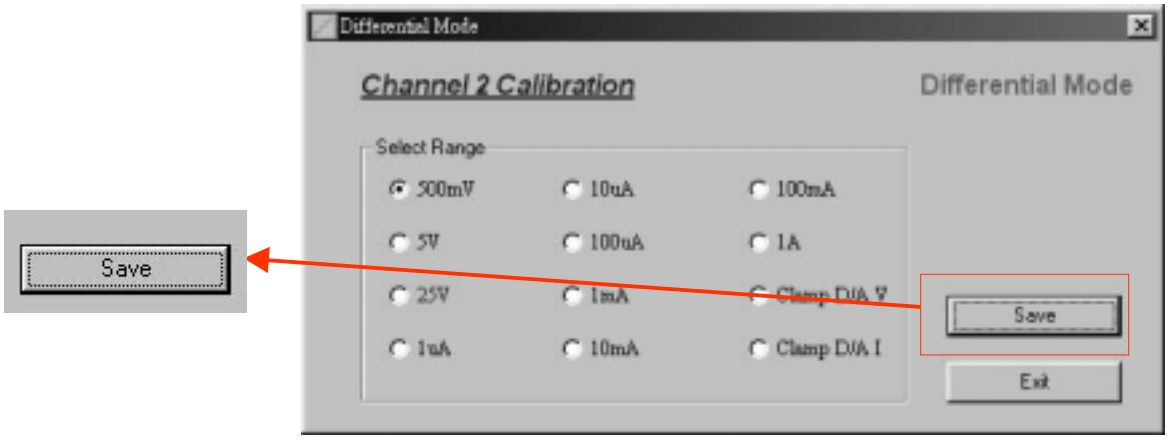

*Figure 5-19. Location of "**Save**" Button on Calibration Form.*

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APPENDIX B

Options and Accessories

SM25 Cable Option
SM25-002

Mating Cable, 5 ft long with Four Triax Connectors. Note: A separate mating cable must be used for each channel of a dual-channel SM25. See Figs B-1 and B-2 for pinout information.

Extra User's Manual
SM25-001

Extra SM25 User's Manual.

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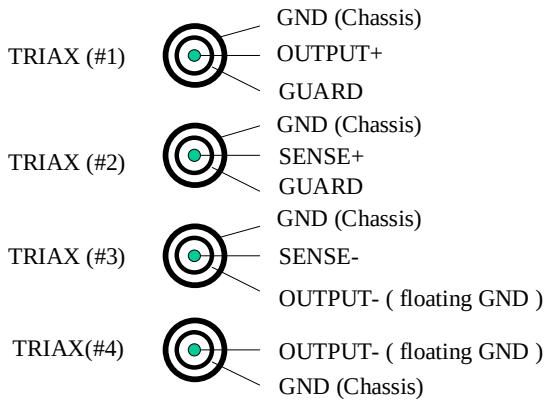

Figure B-1. Pinouts, Triax Signal Cables.

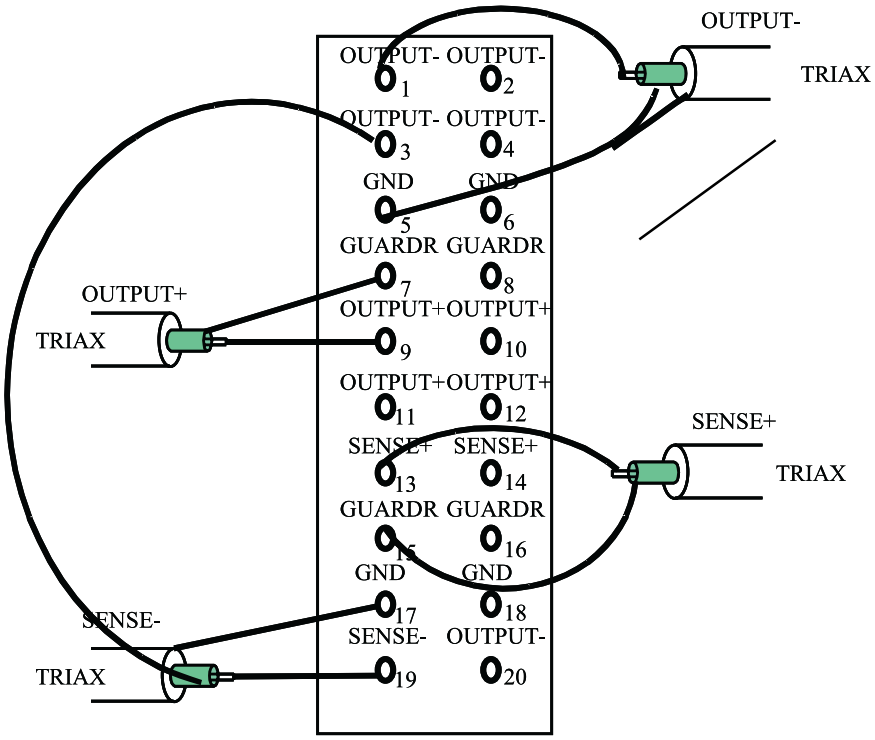

Figure B-2. Pinouts, 20-Pin Connector.

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APPENDIX C

SM25 Specifications

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*SM25 SPECIFICATIONS**

Specification Conditions

Preliminary 40 minutes warm up; ambient temp. (23° C ± 5° C); ambient temperature variations less than 1.5° C after auto calibration execution; Integration time = slow; filter = ON; Kelvin connection; calib. period = 1 year.

Common Mode Noise < 100 mVpp (200 mVpp in cascade option), measured between Output- and Chassis GND

Differential Mode Noise (DC - 20 MHz BW) < 40 mVpp, measured between Output+ and Output-

Transient Response Time 40 µs, min.

Settling Time 150 µs, minimum time required to reach 0.1% of final value after command is processed on resistive load

Output Slew Rate 0.06 V/µs, typical on 0.5 V, 5 V, 25 V ranges, 100 mA compliance; 0.06 A/µs, typical 1 A, and 25 V range

Maximum Pulse Duty Cycle 100%, software programmed

Maximum Pulse Width On time = 65.535 seconds
Off time = 65.535 seconds

Minimum Pulse Programming Resolution 1 ms

Minimum Pulse Width 400 µs

Source:

Voltage Range	Resolution	Accuracy (18-28° C)	Noise (Vpp, 0.1-10 Hz)
500 mV	20 µV	0.1% ± 600 µV	20 µV
5.00 V	200 µV	0.1% ± 900 µV	200 µV
25.00 V	1 mV	0.1% ± 2.5 mV	1 mV

Noise (Source V, Measure I)

I Range	DC-20 MHz BW, Vpp
1A	< 40 mV
100 mA	< 35 mV
10 mA	< 35 mV
1 mA	< 35 mV
100 µA	< 35 mV
10 µA	< 35 mV
1 µA	< 25 mV

Maximum Voltage 25 V @ 800 mA; 20 V @ 1000 mA

Source/Sink Limits ± 20 V @ 1 A; ± 25 V @ 0.8 A

Current Limit Bipolar current limit (compliance) set with single value. Min. 2% of range accuracy: 1% of selected range

Overshoot < 0.1% typical (full scale step, resistive load, 10 mA range)

Current Range	Resolution	Accuracy (18-28° C)	Noise (Vpp, 0.1-10 Hz)
1.00 µA	50.0 pA	0.1% ± 600 pA	10 pA
10 µA	500.0 pA	0.1% ± 2.5 nA	100 pA
100 µA	5.0 nA	0.1% ± 25 nA	1 nA
1.0 mA	50.0 nA	0.1% ± 250 nA	10 nA
10 mA	500.0 nA	0.1% ± 2.5 µA	200 nA
100 mA	5.0 µA	0.1% ± 25 µA	5 µA
1,000 mA	50.0 µA	0.1% ± 900 µA	50 µA

Maximum Current 800 mA @ 25 V, 1000 mA @ 20 V

Source/Sink Limits ± 1 A @ 20 V, ± 0.8 A @ 25 V

Maximum Power Output
20 W/ Channel, 40 W/Module, 4 quadrant source or sink operation

Voltage Limit
Bipolar Voltage limit (compliance) set with single value. Min 2% of range, accuracy: 1% of selected range

Overshoot
< 0.1% typical (1 mA step, 10k ohm load, 25 V range)

***Note:** Accuracy is derated 10% per 0.1 A, if continuous output current time exceeds 1 minute on 1 A range.*

Measure:

Voltage Range	Resolution	Accuracy (18-28° C)
500 mV	20 µV	0.05% ± 600 µV
5.00 V	200 µV	0.05% ± 900 µV
25.00 V	1 mV	0.08% ± 2.5 mV

Current Range	Resolution	Accuracy (18-28° C)
1 µA	50 pA	0.05% ± 600 pA
10 µA	500 pA	0.05% ± 2.5 nA
100 µA	5 nA	0.05% ± 25 nA
1 mA	50 nA	0.05% ± 250 nA
10 mA	500 nA	0.05% ± 2.5 µA
100 mA	5 µA	0.1% ± 25 µA
1000 mA	50 µA	0.25% ± 900 µA

VXI Specifications

Type	Register-based
Revision	2.0
Size	C-size, single-slot
Configuration	Static
Addressing	A16/24
Data Transfers	D16

Power Rqmts.	(2 channels)		(1 channel)	
+5.0 volts	1.00 A	5.0 W	1.00 A	5.0 W
+12.0 volts	0.50 A	6.0 W	0.25 A	3.0 W
-12.0 volts	0.50 A	6.0 W	0.25 A	3.0 W
+24.0 volts	2.1 A	50.4 W	1.06 A	25.4 W
-24.0 volts	2.1 A	50.4 W	1.06 A	25.4 W
		---		---
Total Power		117.8 W		61.8 W

Cooling Requirements (1 channel / 2 channel)

Per-slot Average	62 W / 118 W maximum
Airflow	4.5 / 8.0 L/sec @ 0.38 / 0.45 mm water pressure for 10° C temperature rise

Environmental

Temperature	Storage = -25° C to +60° C Operating = 0° C to +50° C
Humidity	5% to 70% relative, non-condensing

Software Drivers

National Instruments	LabWindows/CVI

* Specifications subject to change without notice.

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Interface Technology, Inc.
300 S. Lemon Creek Dr., Walnut, CA 91789
Tel: 909/595-6030 - Fax: 909/595-7177
e-mail: info@interfacetech.com - Internet: www.interfacetech.com

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